	KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.												
1	**TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.**												
	PROGRAMME NAME: MECHANICAL ENGINEERING						**PROGRAMME CODE: ME**						
	PATTERN: FULL TIME						**DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)**						
	SEMESTER: I						**SCHEME: C-15**						

Sl.no	Course Name	Teaching Department	Course/QP code	Teaching Scheme					Examination Scheme					
				Contact Hours										
				TH	TU	PR	Total	Credit	Exam Paper Duration in Hrs	Semester End Exam		CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
										Max Marks	Min Marks			
1	Communication Skills in English	Sc&Huma	**15CP01E**	4	-	-	4	4	3	100	35	25	125	45
2	Engineering Mathematics-I	Sc	**15SC01M**	4	-	-	4	4	3	100	35	25	125	45
3	Work Shop Technology	ME	**15ME11T**	4	-	-	4	4	3	100	35	25	125	45
4	Engineering Graphics-I	ME	**15ME12D**	-	2	4	6	3	4	100	35	25	125	45
5	Basic Computer Skills Lab	ME	**15ME13P**	-	2	4	6	3	3	50	25	25	75	35
6	Basic Workshop Practice -I	ME	**15ME14P**		2	4	6	3	3	50	25	25	75	35
			Total	12	6	12	30	21		500	190	150	650	250

1 Hr Theory = 1 Credit :: 2Hrs Practical/TU = 1 Credit .

QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

2		KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.
		TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.
		PROGRAMME NAME: MECHANICAL ENGINEERING		PROGRAMME NAME: MECHANICAL ENGINEERING
		PATTERN: FULL TIME		DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)
		SEMESTER: II		SCHEME: C-15

Sl.no	Course Name	Teaching Department	Course/QP code	TH	TU	PR	Total	Credit	Exam Paper Duration in Hrs	Max Marks	Min Marks	CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
1	Engineering Mathematics - II	Sc	**15SC02M**	4			4	4	3	100	35	25	125	45
2	Applied science	Sc	**15SC03S**	4			4	4	3	100	35	25	125	45
3	Basic Electrical & Electronics Engineering	EE	**15EE01E**	4			4	4	3	100	35	25	125	45
4	Engineering Graphics-II	ME	**15ME21D**	-	2	4	6	3	4	100	35	25	125	45
5	Applied Science Lab	Sc	**15SC04P**		2	4	6	3	3	50	25	25	75	35
6	Basic Electrical & Electronics Lab	EE	**15EE02P**		2	4	6	3	3	50	25	25	75	35
			Total	12	6	12	30	21		500	190	150	650	250

Note: Teaching Scheme columns are TH, TU, PR, Total, Credit under "Contact Hours". Examination Scheme includes Exam Paper Duration in Hrs, Semester End Exam (Max Marks, Min Marks), CIE Marks, Total Marks, Min Marks for passing (including CIE marks).

1 Hr Theory = 1 Credit :: 2Hrs Practical/TU = 1 Credit .

QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

					Teaching Scheme					Examination Scheme					
					Contact Hours										
Sl.no	Course Name	Teaching Department	Course /QP code	TH	TU	PR	Total	Credit	Exam Paper Duration in Hrs	Semester End Exam		CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
										Max Marks	Min Marks			
1	Strength of Materials	ME	15ME31T	4			4	4	3	100	35	25	125	45
2	Mechanics of machines	ME	15ME32T	4			4	4	3	100	35	25	125	45
3	Mechanical Measurements	ME	15ME33T	4			4	4	3	100	35	25	125	45
4	Machine Drawing	ME	15ME34D		2	4	6	3	4	100	35	25	125	45
5	Mechanical Computer Aided Drafting (MCAD)	ME	15ME35P		2	4	6	3	3	50	25	25	75	35
6	Basic Work Shop -II	ME	15ME36P		2	4	6	3	3	50	25	25	75	35
7	Mechanical Testing & Quality Control Lab	ME	15ME37P		2	4	6	3	3	50	25	25	75	35
				12	8	16	36	24		550	215	175	725	285

KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.
PROGRAMME NAME: MECHANICAL ENGINEERING **PROGRAMME NAME: MECHANICAL ENGINEERING**
PATTERN: FULL TIME **DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)**
SEMESTER: III **SCHEME: C-15**

3

1 Hr Theory = 1 Credit :: 2Hrs Practical/TU = 1 Credit .
QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

				KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.
4				TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.
			PROGRAMME NAME: MECHANICAL ENGINEERING	PROGRAMME NAME: MECHANICAL ENGINEERING
			PATTERN: FULL TIME	DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)
			SEMESTER: IV	SCHEME: C-15

Sl.no	Course Name	Teaching Department	Course/QP code	Teaching Scheme — Contact Hours					Examination Scheme						
				TH	TU	PR	Total	Credit	Exam Paper Duration in Hrs	Semester End Exam		CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
										Max Marks	Min Marks			
1	Hydraulics & Pneumatics	ME	15ME41T	4			4	4	3	100	35	25	125	45
2	Basic Thermal Engineering	ME	15ME42T	4			4	4	3	100	35	25	125	45
3	Machine Tool Technology	ME	15ME43T	4			4	4	3	100	35	25	125	45
4	Professional Ethics & Indian Constitution	ME	15ME44T	4			4	4	3	100	35	25	125	45
5	Hydraulics & Pneumatics Lab	ME	15ME45P		2	4	6	3	3	50	25	25	75	35
6	Machine shop	ME	15ME46P		2	4	6	3	3	50	25	25	75	35
7	C Programming lab	ME	15ME47P		2	4	6	3	3	50	25	25	75	35
				16	6	12	34	25		550	215	175	725	285

1 Hr Theory = 1 Credit :: 2 Hrs Practical/TU = 1 Credit .
QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

	5		KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.											
			TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.											
			PROGRAMME NAME: MECHANICAL ENGINEERING						PROGRAMME NAME: MECHANICAL ENGINEERING					
			PATTERN: FULL TIME						DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)					
			SEMESTER: V						SCHEME: C-15					
Sl no	Course Name	Teaching Department	Course /QP code	Teaching Scheme					Examination Scheme					
				Contact Hours										
				TH	TU	PR	Total	Credit	Exam Paper Duration in Hrs	Semester End Exam		CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
										Max Marks	Min Marks			
1	Industrial Management	ME	15ME51T	4	-	-	4	4	3	100	35	25	125	45
2	Applied Thermal Engg.	ME	15ME52T	4	-	-	4	4	3	100	35	25	125	45
3	Machine Design	ME	15ME53T	4	-	-	4	4	3	100	35	25	125	45
4	Mechatronics	ME	15ME54T	4	-	-	4	4	3	100	35	25	125	45
5	Professional Practices	ME	15ME55P	-	2	4	6	3	3	50	25	25	75	35
6	Thermal Engg. Lab	ME	15ME56P	-	2	4	6	3	3	50	25	25	75	35
7	Mechatronics Lab	ME	15ME57P	-	2	4	6	3	3	50	25	25	75	35
8	Project work-I	ME	15ME58P	-	-	3	3	-	-	-	-	25	25	-
				16	6	15	37	25		550	215	200	750	285

1 Hr Theory = 1 Credit :: 2Hrs Practical/TU = 1 Credit .
QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

	6	KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.												
		TEACHING AND EXAMINATION SCHEME FOR DIPLOMA PROGRAMME.													
		PROGRAMME NAME: MECHANICAL ENGINEERING							PROGRAMME NAME: MECHANICAL ENGINEERING						
		PATTERN: FULL TIME							DURATION OF PROGRAMME: 3 YEARS (6 SEMESTERS)						
		SEMESTER: VI							SCHEME: C-15						

Sl. no	Course Name	Teaching Department	Course/QP code	Teaching Scheme					Examination Scheme						
				Contact Hours					Exam Paper Duration in Hrs	Semester End Exam		CIE Marks	Total Marks	Min Marks for passing (including CIE marks)
				TH	TU	PR	Total	Credit		Max Marks	Min Marks			
1	Estimation & Costing	ME	15ME61T	4	-	-	4	4	3	100	35	25	125	45
2	Computer Integrated Manufacturing	ME	15ME62T	4	-	-	4	4	3	100	35	25	125	45
3	Elective Course	ME	***	4			4	4	3	100	35	25	125	45
4	CNC Lab	ME	15ME64P	-	2	4	6	3	3	50	25	25	75	35
5	Computer Aided Analysis and Simulation Lab (CASA)	ME	15ME65P	-	2	4	6	3	3	50	25	25	75	35
6	Project Work-II	ME	15ME66P	-	2	4	6	3	3	50	25	25	75	35
7	In plant Training	ME	15ME67P	-	-	4	4	2	-	-	-	25	25	-
				12	6	16	34	23		450	180	175	625	240

1 Hr Theory = 1 Credit :: 2 Hrs Practical/TU = 1 Credit .

QP Code- Question Paper code :: TH-Theory Hours :: TU-Tutorial :: PR-Practical

***Elective Courses/Course Code:**

1.Automobile Engg.-15ME63A	2.Power Plant Engg.-15ME63B	3.Renewable Energy Resources-15ME63C	4.Refrigeration & Air conditioning-15ME63F

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

GOVERNMENT OF KARNATAKA
Department of Technical Education
Curriculum Development Cell
Diploma in Mechanical Engineering
Vision

To develop a programme with excellence in teaching, learning to produce globally compatible diplomats with ethical values as per the need of stake holders

Mission

The mission of the Mechanical Engineering Program is to benefit the society at large by

- **M1: Imparting quality technical education to students by providing excellent Teaching learning Environment and through competitive curriculum in collaboration with industry.**

- **M2: Able to apply basic and contemporary science, engineering and innovative skills to identify problems in the industry and academia and be able to develop practical solution to them**

- **M3: Providing experiences in leadership, teamwork, communications — oral, written and hands-on activities, with the help of structured and unstructured real-life projects.**

- **M4: Encouraging ethical values and leadership abilities in the minds of students so as to work towards the growth of the society.**

Programme Educational Objectives (PEOs)

1. To prepare students for successful careers in industry to meet changing demands of their profession and instil a desire to learn continuously

2. To provide students a strong foundation in mathematics, science, and sound basic theoretical knowledge along with required practical skills in the core areas of Mechanical Engineering to demonstrate technical excellence

3. To inculcate team work capabilities and communication skills among students through Seminars, projects, and industry interactions.

4. To create awareness on environmental issues and commitment towards professional ethics and social responsibilities and need for lifelong learning.

Mapping Of PEOs WITH MISSION STATEMENTS

PEO	M1	M2	M3	M4
To prepare students for successful careers in industry to meet changing demands of their profession and instil a desire to learn continuously	X	X	X	X
To provide students a strong foundation in mathematics, science, and sound basic theoretical knowledge along with required practical skills in the core areas of Mechanical Engineering to demonstrate technical excellence	X	X	X	-
To inculcate team work capabilities and communication skills among students through Seminars, projects, and industry interactions	X	-	X	X
To create awareness on environmental issues and commitment towards professional ethics and social responsibilities and need for lifelong learning.	X	X	X	X

Legend X: Linked

Programme Outcomes (POs)

A Diploma **(Mechanical Engineering)** *graduate is able to:*

1. An ability to apply knowledge of basic mathematics, science and Basic engineering to solve the broadly defined Mechanical engineering problems.(**Basic knowledge)**

2. An ability to apply discipline - specific knowledge to solve broadly defined Mechanical engineering problems.(**Discipline knowledge**)

3. An ability to conduct standard tests and measurements, and to analyze, and interpret experiments results **(Experiments and practice)**

4. An ability to apply the knowledge, techniques, skills, and modern tools of Mechanical engineering discipline to broadly-defined engineering technology activities.**(Engineering Tools)**

5. Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice(**The engineer and society**)

6. Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
   (**Environment and sustainability**)

7. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. **(Ethics**)

8. Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.(**Individual and team work)**

9. An ability to apply written, oral, and graphical communication in both technical and nontechnical environments and the ability to use appropriate technical literature **(Communication)**

10. Recognize the need for, and have the preparation and ability to engage in independent

and life-long learning in the context of technological changes **(Life-long learning)**

Mapping Of PEOs WITH POs

Programme Educational Objectives	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
To prepare students for successful careers in industry to meet changing demands of their profession and instil a desire to learn continuously	X	X	X	X	X	X	X	X	X	X
To provide students a strong foundation in mathematics, science, and sound basic theoretical knowledge along with required practical skills in the core areas of Mechanical Engineering to demonstrate technical excellence	X	X	X	X	X	X	X	X	X	X
To inculcate team work capabilities and communication skills among students through Seminars, projects, and industry interactions	X	X	X	X	X	X	X	X	X	X
To create awareness on environmental issues and commitment towards professional ethics and social responsibilities and need for lifelong learning	-	-	-	-	X	X	X	X	X	X

Legend X: Linked

OUT COME BASED CURRICULAM COURSE COMPONENTS OF THE DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING

The Diploma Programme in Mechanical engineering shall consist of curricular component comprising courses in General Studies, Applied Sciences, Basic Courses in Engineering Departmental Core, and, Specialised Courses in Mechanical Engineering (Electives in emerging areas).

General Studies

All disciplines shall contain courses in general studies and communication. These are related to *supervisory / management skills*. Further, development of *communication skills* appropriate to functions of technicians and also complementary to the main courses of the respective programmes is considered. In addition, courses offered include areas productivity and quality, safety and entrepreneurial development. A general course on computer literacy and *computer applications* is essentially included.

Applied Sciences

Courses under Applied Sciences include *Mathematics*, *Sciences*. Topics for these courses are chosen depending on their requirement for study of the Basic, Interdisciplinary and Departmental Core courses, as well as to help the students to pursue higher level of studies in chosen areas.

Basic Courses in Engineering & Technology

Courses in basic Engineering & Technology include *Basic Electrical and Electronics Engineering and Basic Electrical and Electronics Engineering Laboratory*. These are necessary for Mechanical disciplines as this will help in the study of the Interdisciplinary and Departmental Core courses.

Departmental Core courses

These form the core studies relevant to the specific programme and are meant to develop competencies required and students acquire outcomes as desired by the profession. One of the courses would be essentially Project work, which is intended to provide opportunity for students to develop understanding of the inter relationship between courses and to apply the knowledge gained in a way that enables them to develop and demonstrate higher order skills. Project work has been given due weightage in terms of time (one year long duration spreading in V semester and VI semester). Industry-Institution-Interaction should be an integral component of curriculum wherever possible.

Specialised Courses in Engineering (Electives)

Vide Courses under electives are offered to provide an avenue for limited specialisation in an area of the students' choice and should cover new and emerging areas. Examples of such courses are *Plant engineering and industrial safety* (Mechanical), *"Renewable energy sources"* (Mechanical), *"Power plant engineering"* (Mech), *"Tool engineering"* (Auto),) *Refrigeration and air conditioning* (Mechanical), *"Self employment and entrepreneurship development"* (Mechanical), *"Power plant engineering"* (Mech), *"Automobile engineering"* (Auto),) etc.

A summary of the new curricular structure for the Diploma Programmes in Engineering & Technology is illustrated below:—

Fig. 1: Distribution of the Different courses of the New Curiculum

Fig. 1 : Distribution of Different Courses of the New Curriculum
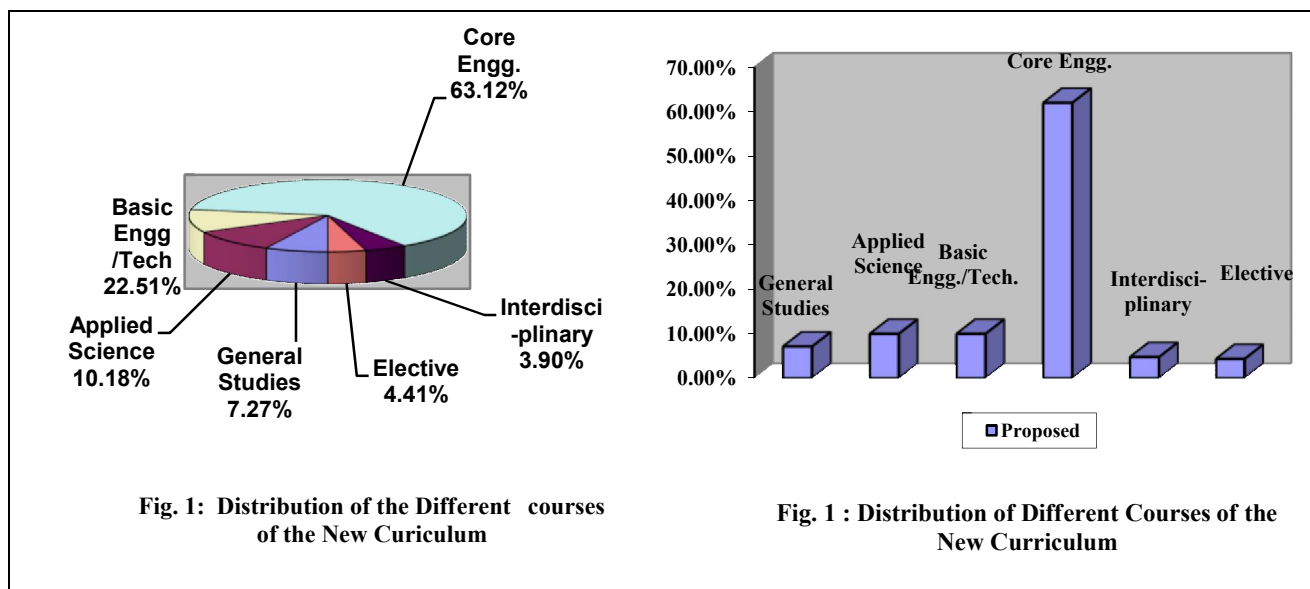
COURSES OF PROGRAMME	1ST SEM.	2ND SEM.	3rd SEM.	4th SEM.	5th SEM.	6th SEM.	TOTAL (%)
GENERAL STUDIES	1	—	—	1	-	1	3 (07.14%)
APPLIED SCIENCE	2	2	—	—	—	—	4 (10.00%)
BASIC ENGINEERING	1	2	1	—	—	—	4 (10.00 %)
APPLIED ENGINEERING (DEPT. CORE)	2	2	6	6	5	5	26 (62%)
INTERDISCIPLINARY	—	—	—	—	2	—	2 (4.76%)
SPECIALISED COURSES (ELECTIVE)	—	—	—	—	1	1	2 (04.33%)
T O T A L	6	6	7	7	8	8	42 (100.00%)

DIPLOMA IN MECHANICAL ENGINEERING
II YEAR Curriculum Drafting Committee
2015-16

Sl No	Name	Designation	Remarks
1	H.L.KANTHARAJAPPA	Principal,GPT,Bagepalli	Chairman
2	Ravishankar C.V	SGL/Mech GPT KGF	Member
3	Venkatesha Babu S G	SGL/Mech GPT Ramanagar	Member
4	Hiremath V.C	SGL/Mech KHKIE Dharawad	Member
5	Vinayaka K.R	SGL/Mech MEI Polytechnic Bangalore	Member
5	Sebith	L/Mech GPT Siddapur	Member
6	Mahendra T K	L/Mech, CPC Mysuru	Member
7	Satish R C	L/Mech GPW ShiralaKoppa	Member
8	B.Nagabhushana	Senior manager-Production Engineering and Services, TOYOTA KIRLOSKAR, Bangalore	Nominee-Industry
9	K.Krishnmurthy	Manager-HAL, Bangalore	Nominee-Alumni
10	Smt.Jaya N	Senior Technical Asst,LPSC,ISRO, Bangalore	Nominee-Alumni

Curriculum Review Committee
2015-16

Sl No	Name	Designation	Remarks
1	Ravishankar C.V	SGL/Mech GPT KGF	Member
2	Ravi H N	SGL/Mech GPT Srirangapatna	Member
3	Hiremath V.C	SGL/Mech KHKIE Dharawad	Member
4	Vinayaka K.R	SGL/Mech MEI Polytechnic Bangalore	Member

Curriculum Review Committee
(For 5th and 6th Semester C-15 syllabus)
2016-17

Sl No	Name	Designation	Remarks
1	Mr. Ravishankar C V,	Selection Grade Lecturer/ME, Government Polytechnic, KGF	Member
2	Mr. M. Srinivasa	Selection Grade Lecturer/ME, Government Polytechnic, Chintamani	Member
3	Mr. Umashankar R	Selection Grade Lecturer/ME , DACG Chikkamangalore	Member
4	Mr. C. D. Mahesha	Selection Grade Lecturer/ME , CPC Polytechnic, Mysore	Member
5	Mr. Kashinath S V H	Lecturer/ME , Government Polytechnic, Channapatna	Member

Course Title	: **COMMUNICATION SKILLS IN ENGLISH**	Course Code	: **15CP01E**
Semester	: **I / II**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **4:0:0** (in hours)	Credits	: **4 Credits**
Type of course	: **Theory**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**

Pre-requisites:

- Basic Knowledge of Grammar
- Listening, Speaking, Reading and Writing Skills as acquired in Secondary Education

Course Objectives:

The students shall be able to:

- Learn to apply the basic grammar in day to day communication in English
- Comprehend the given ideas in a passage and be able to effectively express the same in written form
- Enrich their vocabulary through reading
- Face oral examinations and interviews
- Express their ideas creatively through (spoken/written) exercises

Course Delivery:

The Course will be delivered through lectures, class room interactions, exercises and case studies as detailed below:

Sl. No.	Description	Teaching contact hours
1.	Text	24
2.	Grammar	18
3.	Descriptive writing	5
4.	Comprehension	5
Total		**52**

Text book: Communication Skills in English for Polytechnics – by **ORIENT BLACKSWAN** publishers – published by NITTTR Chennai

Course Content:

UNIT I: CAREER PLANNING (09Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Spelling; Grammar- Parts of Speech; Newspaper Reading and Comprehension; Descriptive Writing – Describing Objects; Listening/ Speaking Exercise – Self Introduction.

UNIT-II: THE GREAT INDIAN PSYCHOTHERAPY (09Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Prefixes and Suffixes; Grammar – Articles and Prepositions; Descriptive Writing – Describing People; Listening/ Speaking Exercises – Listening to speeches and writing gist of it in one's own words.

UNIT III: GLOBAL WARMING (08Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Synonyms and Antonyms; Grammar – Auxiliaries, Question Tags and Short-form Answers; Descriptive Writing – Describing Places; Listening/ Speaking Exercises – Narrating one's own experiences of different situations in their day- to-day life.

UNIT IV: RENDEZVOUS WITH A WOMAN CORPORATE GIANT (09Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Homonyms, Homophones, Homographs; Grammar – Subject-Verb Agreement; Descriptive Writing – Describing Processes; Listening/ Speaking Exercises – A short presentation on a given topic ;Paraphrasing of Proverbs; Different kinds of Interviews.

UNIT V: A UNIQUE PATIENT (09 Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Compound words; Grammar –Tenses; Descriptive Writing – Describing Events (Eg: College Day, National Festivals, Etc.); Comprehension of a paragraph; Quiz – Questions on health and hygiene.

UNIT VI: A FARMER'S WIFE (08 Hrs)

Glossary; Comprehension Exercises; Vocabulary Exercises – Formation of plurals; Grammar – Active and Passive Voices; Descriptive Writing – Describing one's goal and its attainment; Developing hints into a paragraph; Comprehension of an unseen passage.

Reference Books:

1. **HIGH SCHOOL ENGLISH GRAMMAR AND COMPOSITION** BY WREN AND MARTIN (S.CHAND & CO.)
2. **THE KING'S GRAMMAR** BY SANJAY KUMAR SINHA (S.CHAND & CO.)
3. **STRENGTHEN YOUR WRITING** BY V.R. NARAYANA SWAMY (ORIENT BLACKSWAN)

4. **ESSENTIAL ENGLISH** BY E. SURESH KUMAR et.al (ORIENT BLACKSWAN)
5. **ENGLISH GRAMMAR &COMPOSITION AND EFFECTIVE BUSINESS COMMUNICATION** BY M.A.PINK AND THOMAS S.E. (S.CHAND & CO.)

6. **WHAT YOUNG INDIA WANTS: SELECTED ESSAYS AND COLUMNS** BY CHETAN BHAGAT (RUPA PUBLICATION, NEW DELHI)

7. **CHICKEN SOUP FOR THE INDIAN DOCTOR'S SOUL** BY JACK CANFIELD et.al (WESTLAND LIMITED PUBLISHERS)

8. **SOFT SKILLS** BY K. ALEX(S.CHAND AND COMPANY)
9. **"REFLECTIONS"**: I PUC ENGLISH COURSE BOOK, PUBLISHED BY DEPT.OF PRE-UNIVERSITY EDUCATION, GOVT OF KARNATAKA

10. **A PRACTICAL COURSE FOR WRITING SKILLS IN ENGLISH**BY J.K.GANGAL. (PHI PUBLICATIONS)

11. **ENGLISH LANGUAGE LABORATORIES** – A COMPREHENSIVE MANUAL BY NIRA KONAR (PHI LEARNING)

Course outcomes:

On successful completion of the course, the student will be able to:

1. Read their text, and respond to basic comprehension questions

2. Enhance the students' English grammar skills by using the following grammatical components in written and verbal communication

    - Parts of speech
    - Auxiliaries
    - Articles
    - Tenses
    - Active and Passive voice
    - Prepositions
    - Question Tags and Short form answers
    - Prefixes and Suffixes
    - Subject-Verb Agreement
    - Homonyms/Homophones/ Synonyms /Antonyms

3. Communicate an idea in series logically connected sentences by describing an event such as objects, people, places, processes, expanding proverbs and also conducting activity such as group discussion, presentation, reporting and documentation

4. Comprehend the given passage and able to answer the linked questions

Mapping Course Outcomes with Program Outcomes:

CO –PO Mapping

CO	Course Outcome	PO Mapped	Cognitive Level	Theory Sessions	Allotted marks on cognitive levels			TOTAL
					R	**U**	**A**	
CO1	Read their text, and respond to basic comprehension questions	5, 6, 7,9	R/U	24	30	25	-	55
CO2	Enhance the student English grammar skills by using the following grammatical components in written and verbal communication • Parts of speech • Auxiliaries • Articles • Tenses • Active and Passive voice • Prepositions • Question Tags and Short form answers • Prefixes and Suffixes • Subject-Verb Agreement • Homonyms/Homophones/ Synonyms /Antonyms	9	U/A	18	-	16	25	41
CO3	Communicate an idea in series logically connected sentences by describing an event such as objects, people, places, processes, expanding proverbs and also conducting activities such as group discussion, presentation, reporting and documentation	7,8,9,10	U/A	7	-	-	15	15
CO4	Comprehend the given passage and able to answer the linked questions	8,9,10	U/A	3	-	10	-	10
			Total Hours of instruction	52	**Total marks**			121

R-Remember; U-Understanding; A-Application

Course outcomes –Program outcomes mapping strength

Course	Program Outcomes									
	1	2	3	4	5	6	7	8	9	10
COMMUNICATION SKILLS IN ENGLISH	-	-	-	-	3	3	3	1	3	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Question Paper Blue Print:

Course: COMMUNICATION SKILLS IN ENGLISH
Course code: 15CP 01E

Sl. No.	Content	Knowledge	Comprehension	Application	Total
1.	**TEXT**				**55**
a	Lesson	30	25		
2.	**GRAMMAR**				**41**
a	Parts of speech			4	4
b	Auxiliaries: Primary and Modals			3	3
c	Articles			3	3
d	Identification of tenses			4	4
e	Active and Passive voice			4	4
f	Prepositions	4			4
g	Question tags			3	3
h	Short form answers			2	2
i	Prefixes and Suffixes	2			2
j	Homonyms/Homophones/	4			4
k	Synonyms and Antonyms	4			4
l	Agreement of the Verb with its Subject	4			4
3.	**DESCRIPTION WRITING**				**15**
a	Descriptive writing – Describing objects, people and places, Process and Events			15	
4.	**COMPRHENSION**				**10**
a	Comprehension of an unseen passage		10		
	Total	**48**	**35**	**38**	**121**

Question Paper Pattern:

Sl. No.	Source	Question	Type	Marks
1.	Textual Units	Answer any twelve of the following questions in one or two sentences each	15 questions to be asked from 6 Textual Units	12 x 2 = 24
2.	Textual Units	Write short notes on any three of the following	5 questions to be asked from 6 Textual Units	3 x 5 = 15
3.	Grammar	Identify the parts of speech of the underlined words	4 sentences are to be given and word to be identified is underlined	4 x 1= 4
4.	Grammar	Fill in the blanks using suitable Auxiliaries	3 sentences are to be given.	3 x 1= 3
5.	Grammar	Fill in the blanks using suitable Articles	3 sentences are to be given	3 x 1=3
6.	Grammar	Identification of Tenses	4 sentences are to be given	4 x 1= 4
7.	Grammar	Active and Passive Voice: Change the voice of the verb in the following sentences	4 sentences are to be given for changing the voice of the verb	4 x 1= 4
8.	Grammar	Prepositions: Fill in the blanks with appropriate prepositions	4 sentences are to be given	4 x 1= 4
9.	Grammar	Question Tags: Add question tags	3 sentences are to be given	3 x 1= 3
10.	Grammar	Short form answers: Give short form answers	2 sentences are to be given	2 x 1= 2
11.	Grammar	Prefixes and Suffixes: Add Prefixes/Suffixes to the stem words	2 stem words are to be given	2 x 1= 2
12.	Grammar	Homonyms, Homophones and Homographs: Use the following words in your own sentences.	4 words are to be given	4 x 1= 4
13.	Grammar	Synonyms / Antonyms: Give the	2 words each are to be given	

		Synonyms/Antonyms for the following words		2 x 1= 2
14.	Grammar	Agreement of the Verb with its Subject: Fill in the blanks with verbs that agree with their subjects	4 sentences are to be given	4 x 1= 4
15.	Composition	Descriptive Writing: Describe objects, people, places and processes	3 questions are to be given	2 x 5 = 10
16.	Composition	Comprehension of an unseen passage: Read the following passage and answer the questions that follow	Questions to be set for 10 marks	10
	Total	-	-	100

Guidelines for Question Paper Setting:

1. The question paper must be prepared based on the blue print without changing the weightage of marks fixed for each category. (As per model question paper)
2. The question paper pattern provided should be adhered to.
3. Care must be taken so that there is only one possible answer for all 'fill in the blanks' questions.

Course Assessment and Evaluation:

	What		To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	**CIE (Continuous Internal Evaluation)**	I A Tests	Students	Three tests (average of three tests will be computed)	20	Blue Books	1 and 2
		Class room Assignments		Any one Activity(*)	05	Log of Activity	3
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	100	Answer Scripts at BTE	1 to 4
Indirect Assessment	Student Feedback on course			Middle Of The Course	Feedback forms		1 to 3 delivery of the course
	End Of Course Survey		Students	End Of The Course	Questionnaire		1 to 4 Effectiveness of delivery of instructions and assessment

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit. Any decimals shall be rounded off to the next higher digit. **Eg: 15.1** should be rounded of to **16**.

* Class room Assignments: Evaluated for any ONE activity

Suggested list of Tutorial Exercises leading to the Development of Speaking Skills
  1. Introducing oneself
  2. Discussion about weather
  3. Discussion about hobbies
  4. Discussing holiday plans
  5. Telephonic conversation
  6. Talking about favorite sports, movie, TV shows etc.
  7. Description about one's goal and its attainment.

8. Any other topic of your/students' choice.

MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

Dimension	RUBRICS FOR ACTIVITY(5 Marks)					
	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Speaks on the given topic	Does not perform any duties assigned to them	Performs very few duties but unreliable	Performs very few duties	Performs nearly all duties	Performs all duties assigned	Ex: 4
Students' Enunciation	Does not enunciate clearly	Enunciation not up to the mark	Enunciation adequate	Enunciation above average	Enunciation extremely good	3
Presentation Skills	Poor presentation	Scope for improvement	Average presentation skills	Presentation effective	Excellent Presentation	2
Submission of Assignment	Does not collect any information relating to the topic	Collects very limited information	Collects some information	Collects much information	Collects a great deal of information	5
Average / Total marks = (4+3+2+5) /4 = 14/4= 3.5 = 4						**4**

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (course coordinator) for assessing the given activity.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1.	Remembering	42
2.	Understanding the course	25
3.	Applying the knowledge acquired from course	33

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/ Date and Time	Semester/ Year	Course / Course Code	Max. Marks
Ex: I test/6 th week of sem. 10-11 a.m.	I/II SEM	COMMUNICATION SKILLS IN ENGLISH	20
	Year: 2015-16	Course Code:15CP01E	

Name of Course Coordinator :   Units: 2 CO's: 2

Question No.	QUESTIONS	MARKS	CL	CO	PO
I	**Answer any <u>five</u> of the following in one or two sentences each:** 1. What do you mean by career? 2. Define 'Career Planning'? 3. What should be the major focus of career planning? 4. What are the questions often asked by the young? 5. What are the three traits as identified by the author? 6. How have the content of our films changed? 7. What has startled global experts?	5x 2 = 10	R/U	1	5,7,9
II	**<u>Grammar:</u>** **1. Identify the parts of speech of the underlined words:** a. **All** spoke in his favour. b. Let us **even** the ground. **2. Fill in the blanks with suitable articles:** a. Charlie is ___ European. b. She is ____untidy girl. **3. Fill in the blanks with appropriate prepositions:** a. Caesar was killed ____Brutus____ a dagger. b. We arrived____ Belagavi_____6 o' clock. **4. Add Suffix and Prefix to the following:** _____ nation_____	2 x 1 = 2 2 x 1 =2 4 x 1 = 4 2 x 1 = 2	U /A	2	9

Sources:

UNIT 1: CAREER PLANNING: **SOFT SKILLS** -BY DR. K. ALEX

UNIT 2: THE GREAT INDIAN PSYCHOTHERAPY: **WHAT YOUNG INDIA WANTS: SELECTED ESSAYS AND COLUMNS** - BY CHETAN BHAGAT

UNIT 3: GLOBAL WARMING: AN ESSAY BY DR. B.M.RAVINDRA, RETD. DY. DIR., DEPT. OF MINES AND GEOLOGY

UNIT 4: RENDEZVOUS WITH A WOMAN CORPORATE GIANT**: ESSENTIAL ENGLISH** BY E. SURESH KUMAR et.al.

UNIT 5: A UNIQUE PATIENT: **CHICKEN SOUP FOR THE INDIAN DOCTOR'S SOUL -** BY JACK CANFIELD et.al.

Government of Karnataka
Department of Technical Education, Bengaluru

Course: COMMUNICATION SKILLS IN ENGLISH

Course code: 15CP 01E

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1.	Mrs. Geetha K.	Selection Grade Lecturer	GRICP, Bengaluru
2.	Mr. C.V. Inamdar	Selection Grade Lecturer	Govt. Polytechnic, Belagavi
3.	Mrs. Bharathi Naik	Selection Grade Lecturer	Women's Polytechnic, Mangaluru
4.	Mrs. Rajyashree Srikant	Selection Grade Lecturer	Govt. Polytechnic, Bagepalli
5.	Mrs. Sunitha M.N.	Selection Grade Lecturer	HMS Polytechnic, Tumakuru
6.	Mr. Deepak Dongre	Selection Grade Lecturer	Govt. Residential Women's Polytechnic, Shivamogga

Review committee

	Name	Designation	Institution
1.	Mrs. Rajyashree Srikant	Selection Grade Lecturer	Govt. Polytechnic, Bagepalli
2.	Mrs. Shailaja D.	Lecturer	Women's Polytechnic, Bengaluru

Code: 15CP 01E

I / II Semester Diploma Examination

COMMUNICATION SKILLS IN ENGLISH

(Common to all Diploma programmes)

Time: 3 Hours]   **[Max. Marks: 100**

Note:

   (i)   Answer all the questions as directed.

  (ii)   Spelling and grammatical errors shall be penalized.

 (iii)   Answers to Question No. I and II are based on the prescribed text.

I.   Answer any TWELVE of the following in one or two sentences each: **2 x 12 = 24**

   1. What do you mean by career?

   2. Define 'Career Planning'?

   3. What should be the major focus of career planning?

   4. What are the questions often asked by the young?

   5. What are the three traits as identified by the author?

   6. How have the content of our films changed?

   7. What is Global Warming?

   8. How does Global Warming occur?

   9. What are the major causes for Global Warming?

  10. What was the usual talk when the parents of the children met?

  11. What ambition did Nooyi's mother have for her daughter?

  12. Who is the sinner according to the poem?

  13. Why did the farmer commit suicide?

  14. Explain in your own words the reason for the farmer's visit to the clinic.

  15. Describe how the doctor fixed the bull's tooth.

II. Write short notes on any THREE of the following: **5 x 3 = 15**

  1. How does career planning play a major role in making career choices?

  2. How does our environment contribute to our numbness to injustice?

  3. Explain in your own words the traditional and modern views of one or two facts expressed in the interview?

  4. Explain in your own words the reason for the farmer's visit to the clinic.

  5. Why does the farmer's wife resolve to live?

III. GRAMMAR:

1. **Identify the parts of speech of the underlined words:**   **4 x 1= 4**
   a. **All** spoke in his favour.
   b. Let us **even** the ground.
   c. I can **shift** for myself.
   d. She lives in **luxury.**

2. **Fill in the blanks with suitable auxiliaries:**   **3 x 1 =3**
   a. You _____ not use calculators in the exam hall.
   b. _____I come in sir?
   c. _____ you lend me your scooter?

3. **Fill in the blanks with suitable articles:**   **3 x 1 = 3**
   a. Charlie is ___ European.
   b. She is ____untidy girl.
   c. What is ____matter?

4. **Identify the tense of the verbs in the following sentences:**   **4 x 1 = 4**
   a. I am writing a letter.
   b. Sun rises in the east.
   c. I have done my homework.
   d. She has been learning western music.

5. **Change the voice of the verb in the following sentences:**   **4 x 1 = 4**
   a. Who did this?
   b. The money was lost.
   c. The cat is chasing the mouse.
   d. He was made the king.

6. **Fill in the blanks with appropriate prepositions:**   **4 x 1= 4**
   a. Caesar was killed ____Brutus____ a dagger.
   b. We arrived____ Belagavi_____6 o' clock.

7. **Add suitable question tag:**   **3 x 1=3**
   a. You were late this morning,_____?
   b. I did not hurt you, _____?
   c. Your father is a doctor, _____?

8. **Give short form answers for the following:**   **2 x 1=2**
   a. Does your father smoke? (Negative)
   b. Have you read today's newspaper? (Affirmative)

9. **Add Suffix and Prefix to the following:**   **2 x 1= 2**
   a. _____ nation_____

10. **Frame sentences using each word to bring out the difference in meaning clearly:**

a. (i) Sight   (ii) Site

b. (i) Present   (ii) Present

11. Give Synonyms to the following words: **2 x 1=2**
   a. Teach
   b. Agree

12. Give Antonyms to the following words: **2 x 1 = 2**
   a. War
   b. Happy

13. Fill in the blanks with verbs to agree with their subjects: **4 x 1 = 4**
   a. Twenty kilometers _____not a long distance.
   b. Either you or I_____ mistake.
   c. Gold and Silver_____ precious metals
   d. The captain with his team _____arrived.

IV. COMPOSITION: (Answer any _two_ in 80 -100 words each)   **5 x 2 = 10**
   1. Describe your favorite tourist place.
   2. Describe the process of preparing tea.
   3. Expand – Work is worship.

V. **COMPREHENSION:**

Read the following passage and answer the questions that follow:

She was all of one-and-a-half years old. Two nurses were holding her down while a third was trying to insert a syringe into a vein to get a blood sample. She was crying loudly, but I was crying even louder. We had no option. It was the fifth day and the fever had not broken; it was imperative that we run the test to rule out typhoid. They finally asked me to leave the room, not just because they were embarrassed at a grown-up crying, but because they thought it would be easier and quicker for the child if the mother was not in the room. They got her out within a few minutes. She jumped into my arms and gave a few more loud wails. Fresh tears streamed down my eyes as we made our way out of the wretched pathology lab. Her paediatrician was getting into the building just then. Between sobs I told him how my daughter had flung the syringe and the lab had to have three attendants on her to collect the sample. As I was talking, my voice broke. To my surprise, Dr. Patel handed me his briefcase and stethoscope, took my girl in his arms and went to the store just a few paces away. He bought her a Cadbury bar and my daughter's face lit up like a million bucks. Gone were the tears, the memory of the syringe, smell of antiseptic, cotton …everything receded to the background as she un wrapped the big bar with her tiny fingers and dug into it with all her heart. I smiled as the angelic doctor handed me my princess.

Meanings of difficult words:

1. **Imperative:** absolutely essential
2. **Wretched:** miserable; unpleasant
3. **Pathology lab:** where the causes and effects of diseases are studied
4. **Receded:** moved back gradually
5. **Paediatrician:** children's doctor
6. **Flung:**(past tense of fling) an act of throwing violently
7. **Attendants:** one who attends

Questions:

1.	How old was the child?	1
2.	What did the nurses have to do to get a blood sample?	2
3.	Why was the mother asked to leave the room?	2
4.	Why does the mother called the pathology lab 'wretched'?	2
5.	How did Dr. Patel calm down the little girl?	2
6.	Suggest a suitable title for this passage.	1

****

Model Question Bank:

Course Title :**COMMUNICATION SKILLS IN ENGLISH**	Course Code: **15CP01E**

I. **ANSWER IN ONE OR TWO SENTENCES EACH:**

1. What do you mean by career?
2. Define 'Career Planning'?
3. What should be the major focus of career planning?
4. List out the benefits of career planning?
5. Identify the guidelines for choosing a career?
6. What are the frequently asked questions about career fields?
7. How do connections help in searching for a suitable job?
8. What are the sample questions asked about a particular job title?
9. What is the role of a career counselor in charting out a career path?
10. List out the factors influencing career decisions?
11. What has startled global experts?
12. What are the questions often asked by the young?
13. What are the three traits as identified by the author?
14. How have the content of our films changed?
15. In what way have we been exposed to corruption from our childhood?

16. How can we contribute to India's progress?
17. What is global warming?
18. How does global warming occur?
19. What are the major causes for Global Warming?
20. What is the quantity of fossil fuel burnt each year?
21. How does the concentration of carbon dioxide in the air increase?
22. Define Greenhouse effect?
23. By burning forests around the world, how much carbon dioxide is added to the atmosphere?
24. What are the steps to be taken to save our environment?
25. What is the possible problem of global warming and its result?
26. What is the effect of global warming?
27. What was the usual talk when the parents of the children met?
28. What ambition did Nooyi's mother have for her daughter?
29. How did Nooyi's mother threaten Nooyi?
30. What good news did Indra Nooyi want to share with her mother?
31. What did Nooyi's mother say when she was told the good news?
32. What lesson did Nooyi learn from her mother?
33. Why does Nooyi's mother take full credit for Nooyi's success?
34. What does Indra Nooyi discover about the language of business in the U.S?
35. What does Indra Nooyi think about herself as a mother?
36. What is the secret of Indra Nooyi's success?
37. How does Indra Nooyi manage time?
38. What is Indra Nooyi's passion?
39. Describe the farmer who visited the dentist's clinic.
41. What was the curious act of the farmer?
42. What request did the farmer make?
43. Why did the doctor almost 'faint in shock'?
44. What did the farmer say when he came back to the clinic?
45. Who do 'you' and 'I' in the poem refer to?
46. Who is the sinner according to the poem?
47. Why did the farmer commit suicide?
48. Explain the meaning of the phrase 'you crossed over'.
49. What are the contrasts depicted by the writer between the farmer's wife and her husband?
50. What memories of her husband trouble her now?

II. ANSWER IN A PARAGRAPH OF NOT MORE THAN 100 WORDS EACH:

1. Write a short note on Guidelines for Choosing a Career.
2. How does career planning play a major role in making career choices?
3. Explain in your own words the first trait of our psyche.
4. How does our environment contribute to our numbness to injustice?
5. Describe the divisiveness that the author talks about.
6. What are the causes and effects of global warming?
7. How does deforestation affect our environment?

8. What information do you gather about Indra Nooyi after going through the interview with Nandan Nilekani?

9. How did Indra Nooyi's mother try to teach her the role of a woman in a family? Do you agree with her?

10. How do you think Indra Nooyi's mother and her husband contribute to her success?

11. What does Indra Nooyi mean when she says "I have to decide every moment in time whether I am going be a mother or a wife or an executive"?

12. Explain in your own words the traditional and modern views of one or two facts expressed in the interview?

13. Explain in your own words the reason for the farmer's visit to the clinic.

14. Describe how the doctor fixed the bull's tooth.

15. Describe the lament of the farmer's wife on her husband's death?

III.GRAMMAR:

1. Fill in the blanks with suitable articles:
   a. Dr. Sanjay is ____ dentist.
   b. My friend is ____ MLA.
   c. Have you ever visited____ Himalayas?
   d. Please bring me ____ cup of coffee.
   e. He is ____untidy boy.
   f. She is ___backbone of her organization.
   g. He is ____ honour to his profession.
   h. Raghu is going to____ mall.
   i. ____world is ___happy place.
   j. I met___ European at ____ party in ____ friend's house.

2. Fill in the blanks with suitable prepositions:
   a. She works __ a big shop __ Jayanagar.
   b. There is a book ____ the floor. Put it __ the table.
   c. I often see Mrs. Dixit __ the station, waiting __ her train.
   d. Mangalore is __ the coast __ the south __ India.
   e. My daughter isn't __ work today because she isn't feeling well.
   f. There were several people __ the bus stop.
   g. Mr. and Mrs. Sharma were __ the shop talking __ the assistant.
   h. Yesterday we spent the day __ the country.
   i. We had lunch __ a pretty little village.
   j. When I was __ the bus stop this morning; I saw two boys __ the church roof.

3. Add appropriate prefixes to form new words:
   a. form   b. regular   c. literate   d. accurate   e. operate
   f. pure   g. fix   h. technic   i. tone   j. national

4. Add appropriate suffixes to form new words:

a. rich   b. love   c. start   d. beauty   e. differ
f. use   g. cheer   h. attract   i. save   j. slow

5. Give the synonyms of the following:
a. release   b. arrive   c. trap   d. happinesse.   e. large
f. teach   g. change   h. confusion   i. discover   j. charge

6. Give the antonyms for the following:
a. rise   b. increase   c. smiled.   d. strict.   e.sadness
f. full   g. host   h. success   i. discover   j. charge

7. Add the correct question tags to the following statements:
a. It is cold,_____?
b. But it isn't as cold as yesterday, ____?
c. It was very cold yesterday,_____?
d. It hasn't been so cold for a long time, ____?
e. It is snowing in the north, ____?
f. It often snows there, ____?

8. Give short form answers for the following:
a. Does Renu work hard?_____._____.
b. Can you swim?_____._____.
c. Are you angry with me?_____._____.
d. Do you like watching movies?_____._____.
e. Have you met our Prime Minister?_____._____.

9. Fill in the blanks with appropriate words from the brackets:
a. His father-in-law owns a _____ farm. (dairy/diary)
b. Diabetics must take extra care of their _____. (feat/feet)
c. Rekha is a popular ____ of Bollywood.(heroin/heroine)
d. The   country   was   prosperous   during   the_____of Krishnadevaraya.(rein/reign/rain)
e. You should be_____ in the class. (quite/quiet)

10. Differentiate between the following pairs of words by using each of them in a sentence of your own:
a. Wrong, rung   b. Principal, principle   c. Hair, hare
d. Gate, gait.   e. Sea, see   f. Fair, fare
g. Some, sum.   h. Sell, cell   i. Weather, whether
j. Birth, berth   k. Vacation, vocation   l. Bear, bare

11. Fill in the blanks with verbs to agree with their subjects:

a. Every seat in the bus ____ taken.
b. All the seats in this bus ____ reserved.
c. One of my friends _____ visiting me this week end.
d. Neither Gopal nor Deepak ____ come today.
e. The Captain of Indian team as well as his players ____ staying here.
f. Intelligence and hard work _____ required to get good marks.
g. Mathematics ____ my favourite subject.
h. _____ your father and mother at home?

12. Identify the tense of the verbs in the following in the sentences.

a. He was listening to her attentively.
b. Raghu denies stealing my purse.
c. She has bought a flat near my house.
d. Kiran fought bravely.
e. The teachers are discussing the details of the annual day function.
f. I am not trying to copy you.
g. Sushma was cooking pasta.
h. The students have been waiting eagerly for the results.
i. Risheeba speaks Tamil very fluently.
j. I have been waiting for her for over an hour.

13. Change the voice:

a. Ramu was making a kite.
b. Close the door.
c. Cable wires have been cut.
d. We prohibit smoking.
e. Everyone loves him.
e. My watch was lost.
f. He was refused admission.
g. Do not insult the poor.
h. Without effort nothing can be gained.
i. They made him captain.

****

Course Title: **ENGINEERING MATHEMATICS – I**	Course Code : **15SC01M**
Semester : **I**	Core / Elective : **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **52**
CIE : **25 Marks**	SEE : **100 Marks**
Programmes: **Common to all Engineering Diploma Programmes**	

Pre-requisites:

Basics in Algebra, Trigonometry and Coordinate Geometry in Secondary Education.

Course Objectives:

1. Apply the concept of matrices and determinants and their applications to solve the linear equation in engineering field.
2. Apply the vector algebra in solving the problems of statics and mechanics.
3. Analyse the civil engineering problems using concepts of probability.
4. Evaluate the advanced engineering mathematical problems using logarithms.
5. Apply and evaluate trigonometric concept in vector engineering field.
6. Create the basic concept of calculus.

Course Content:

Topic and Contents	Hours	Marks
LINEAR ALGEBRA		
UNIT-1: MATRICES AND DETERMINANTS	10	31
(a) **Matrices:** Basic concepts of matrices: Definition, types of matrices and mathematical operations on matrices (addition, subtraction and multiplication of matrices).	02	
(b) **Determinant:** Definition, problems on finding the determinant value of 2nd and 3rd order. Problems on finding unknown quantity in a 2nd and 3rd order determinants using expansion. Solving simultaneous linear equations using determinant method (Cramer's rule up to 3rd order).	04	

(c) Inverse and applications of matrices: Minors and Cofactors of elements of matrix. Adjoint and Inverse of matrices of order 2nd and 3rd order. Elementary row and column operations on matrices. Characteristic equation and characteristic roots (eigen values) of 2x2 matrix. Statement of Cayley-Hamilton theorem and its verification for 2x2 matrix. Solution of system of linear equations using Gauss Elimination method (for 3 unknowns only).	04	

ALGEBRA

UNITS-2: VECTORS	08	27
Definition of vector. Representation of vector as a directed line segment. Magnitude of a vector. Types of vectors. Position vector. Expression of vector by means of position vectors. Addition and subtraction of vectors in terms of line segment. Vector in plane and vector in a space in terms of unit vector i, j and k respectively. Product of vectors. Scalar product and vector product of two vectors. Geometrical meaning of scalar and vector product. Applications of dot (scalar) and cross (vector) products. Projection of a vector on another vector. Area of parallelogram and area of triangle. Work done by force and moment of force.		

UNITS-3: PROBABILITY AND LOGARITHMS	08	14
(a) **Probability:** Introduction. Random experiments: outcomes and sample space. Event: Definition, occurrence of an event, types of events. Algebra of events- complementary event, the events A or B, A and B, A but not B, mutually exclusive events, exhaustive events, defining probability of an event. Addition rule of probability. Conditional probability: definition, properties of conditional probability, simple problems.	06	
(b) **Logarithms:** Definition of common and natural logarithms. Laws of logarithms (no proof). Simple problems on laws of logarithms.	02	

TRIGONOMETRY		
UNIT-4: ALLIED ANGLES AND COMPOUND ANGLES.	16	47
(a) Recapitulation of angle measurement, trigonometric ratios and standard angles. **Allied angles:** Meaning of allied angle. Signs of trigonometric ratios. Trigonometric ratios of allied angles in terms of θ. Problems on allied angles. (b) **Compound angles:** Geometrical proof of sin(A+B) and cos(A+B) and hence deduce tan(A+B). Write the formulae for sin(A-B), cos(A-B) and tan(A-B), problems. Multiple and sub multiple angle formulae for 2A and 3A. Simple problems. Transformation formulae. Expression for sum or difference of sine and cosine of angles into product form. Expression for product of sine and cosine of angles into sum or differences form.	02 06 08	
UNIT-5:COMPLEX NUMBERS	04	09
Meaning of imaginary number i and its value. Definition of complex number in the form of $a + ib$. Argand diagram of complex number $a + ib$ (Cartesian system). Equality of complex numbers. Conjugate of complex number. Algebra of complex numbers, modulus of complex number, principal value of argument of complex number, polar form: $Z = r(cos\theta + i\ sin\theta)$ and exponential form $Z = re^{i\theta}$ of complex number, where r is modulus and θ is principal value of argument of complex number.		
UNIT-6: INTRODUCTION TO CALCULUS	06	17
Limits: Constants and variables. Definition of function. Types of functions: Explicit and implicit function, odd and even functions(definition with example). Concept of $x \rightarrow a$. Definition of limit of a function. Indeterminate forms. Evaluation of limit of functions by factorization, rationalization. Algebraic limits. Statement of $\lim\limits_{x \to a} \frac{x^n - a^n}{x - a} = na^{n-1}$ where n is any rational number. Proof of $\lim\limits_{\theta \to 0} \frac{sin\ \theta}{\theta} = 1$ where θ is in radian. Related problems. Standard limit (statement only) 1. $\lim\limits_{x \to 0} \frac{a^x - 1}{x} = \log_e a$, 2. $\lim\limits_{x \to 0} \frac{e^x - 1}{x} = 1$ 3. $\lim\limits_{n \to \infty} \left(1 + \frac{1}{n}\right)^n = e$, 4. $\lim\limits_{n \to 0}(1 + n)^{\frac{1}{n}} = e$ Simple problems on standard limits.		
TOTAL	**52**	**145**

Course outcomes:

On successful completion of the course, the student will be able to:

1. Find the product of matrices, value of determinants, and inverse of matrix and solve the simultaneous linear equation.
2. Find the product of vectors and their geometrical applications in finding moment of force, work done.
3. Determine probability of various types of events.
4. Solve the problems related to logarithms.
5. Solve the problems on trigonometric functions with angle of any magnitude.
6. Evaluate the limiting value of algebraic and trigonometric functions.

Mapping Course Outcomes with Program Outcomes:

CO	Course Outcome	PO Mapped	Cognitive Level	Theory Sessions	Allotted marks on cognitive levels			TOTAL
					R	U	A	
CO1	Find the product of matrices, value of determinants, and inverse of matrix and solve the simultaneous linear equation	1,2,3	R/U/A	10	9	10	12	31
CO2	Find the product of vectors and their geometrical applications in finding moment of force, work done	1,2,3	R/U/A	8	6	15	6	27
CO3	Determine probability of various types of events	1,2,	R/U/A	8	3	5	6	14
CO4	Evaluate the integrations of algebraic, trigonometric and exponential function	1,2,3,10	R/U/A	16	15	20	12	47
CO5	Solve the problems related to logarithms.	1,2	R/A	4	3	0	6	09
CO6	Evaluate the limiting value of algebraic and trigonometric functions	1,2,10	R/U/A	6	6	5	6	17
		Total Hours of instruction		52	**Total marks**			145

R-Remember; U-Understanding; A-Application

Course outcomes –Program outcomes mapping strength

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Engineering Mathematics-I	3	3	3	-	-	-	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Reference:

1. NCERT Mathematics Text books of class XI and XII.
2. Karnataka State PUC mathematics Text Books of I & II PUC by H.K. Dass and Dr.Ramaverma published by S.Chand & Co.Pvt.Ltd.
3. CBSE Class Xi & XII by Khattar&Khattar published PHI Learning Pvt. ltd.,
4. First and Second PUC mathematics Text Books of different authors.
5. www.freebookcentre.net/mathematics/introductory-mathematics -books.html

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

Method		What	To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	*CIE	Internal Assessment Tests	Student	Three tests (Average of Three tests will be computed).	20	Blue books	1 to 6
		Assignments		Two Assignments based on CO's (Average marks of Two Assignments shall be rounded off to the next higher digit.)	5	Log of record	1 to 6
				Total	25		
	*SEE	Semester End Examination		End of the course	100	Answer scripts at BTE	1 to 6
INDIRECT ASSESSMENT		Student feedback	Students	Middle of the course	-NA-	Feedback forms	1 to 3, delivery of the course
		End of Course survey		End of course		Questionnaire	1 to 6, Effectiveness of delivery of instructions and assessment methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	25
2	Understanding	40
3	Applying the knowledge acquired from the course	30
	Analysis and Evaluation	5

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**ENGINEERING MATHEMATICS –I**	20
	Year:	Course code: **15SC01M**	

Name of Course coordinator :   Units:__ CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Model Question Paper:

Code: 15SC01M

I Semester Diploma Examination

ENGINEERING MATHEMATICS –I
(Common to All Engineering Diploma Programmes)

Time: 3 Hours.]|[Max marks: 100

Note:

(i)   Answer any **Ten** questions from **section-A,** any **Eight** questions from **section-B** and any **Five** questions from **section-C.**

(ii)   Each question carries **3** marks in **section-A**.

(iii) Each question carries **5** marks in **section-B**.

(iv)   Each question carries **6** marks in **section-C**.

SECTION – A

1. Find the product of $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -1 \\ 5 \end{bmatrix}$

2. If $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 1 \\ 0 & -3 \end{bmatrix}$ find adj(AB).

3. If $A + B = \begin{bmatrix} 3 & -7 \\ 0 & 2 \end{bmatrix}$, $A - B = \begin{bmatrix} 1 & 5 \\ 4 & -6 \end{bmatrix}$ find A.

4. If $\vec{a} = i + 2j - 3k, \vec{b} = 3i - 5j + 2k$. Find the magnitude of $2\vec{a} + 3\vec{b}$.

5. If $\vec{A}$=(3,-4), $\vec{B}$= (-5,6) find position vector of A and B and also find $|\overrightarrow{AB}|$

6. Three coins are tossed simultaneously. List the sample space for event.

7. If $\sin \theta = -{}^8/_{17}$ and $\pi < \theta < \frac{3\pi}{2}$ find the value of $4tan\theta + 3sec\theta$.

8. Find the value of $\sin 75^o$ using standard angles.

9. Show that $\frac{cosec(180-A)\cos(-A)}{sec(180+A)\cos(90+A)} = cot^2 A$

10. Prove that $\sin(A + B) \sin(A - B) = \sin^2 A - \sin^2 B$.

11. Prove that $\frac{\sin 3A}{\sin A} - \frac{\cos 3A}{\cos A} = 2$.

12. Express the product $(1 + i)(1 + 2i)$ in $a + ib$ form and hence find its modulus.

13. Evaluate : $\lim_{x \to 3} \left[\frac{x-1}{2x^2-7x+5}\right]$

14. Evaluate: $\lim_{x \to \infty} \left[\frac{3x^2+4x+7}{4x^2+7x-1}\right]$

SECTION – B

1. Find the value of x if $\begin{vmatrix} 1 & x & 0 \\ 2 & -1 & 3 \\ -2 & 1 & 4 \end{vmatrix} = 0.$

2. Find the characteristic equation and its roots of a square matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

3. Find the *sine* of the angle between the vectors $2i - j + 3k$ and $i - 2j + 2k$.

4. If vector $\vec{a} = i + j + 2k, \vec{b} = 2i - j + k$ show that $\vec{a} + \vec{b}$ perpendicular $\vec{a} - \vec{b}$.

5. Find the projection of $\vec{a} = 2i + j - k$ on $\vec{b} = 2i - 3i + 4k$.

6. Prove that $\dfrac{1}{\log_a abc} + \dfrac{1}{\log_b abc} + \dfrac{1}{\log_c abc} = 1$

7. Find the numerical value of $\sin\left(\dfrac{\pi}{3}\right) . \cos\left(-\dfrac{\pi}{3}\right) - \cos\left(\dfrac{\pi}{4}\right) . \sin\left(-\dfrac{3\pi}{4}\right)$

8. Prove that $\sin(A + B) = \sin A \cos B + \cos A \sin B$ geometrically

9. If $A + B + C = \dfrac{\pi}{2}$, prove that $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$.

10. Show that $\dfrac{\sin 56^o - \sin 44^o}{\cos 56^o + \cos 44^o} = \cot 82^o$

11. Evaluate: $\lim\limits_{x \to 0} \left[\dfrac{\sqrt{1+x+x^2} - 1}{x} \right]$

SECTION – C

1. Solve for x, y & z using determinant method

$x + y = 0, y + z = 1 \& z + x = 3$.

2. Solve the equation $x + y + z = 6, 2x - 3y + z = 1 \& x + 3y - 2z = 7$ using Gauss elimination method.

3. A force $\vec{F} = 2i + j + k$ is acting at the point (-3,2,1). Find the magnitude of the moment of force $\vec{F}$ about the point (2,1,2).

4. A die is thrown twice and the sum of the numbers appearing is absorbed tobe. What is the conditional probability that the number 5 has appeared at least once?

5. Prove that $\dfrac{\cos\left(\dfrac{5\pi}{2} - \theta\right)}{\sin(4\pi + \theta)} + \dfrac{\tan(-\theta)}{\cot(\pi - \theta)} = sec^2\theta$

6. Prove that $\cos 80^o \cos 60^o \cos 40^o \cos 20^o = \dfrac{1}{16}$

7. Find the modulus and argument of the complex number $z = -\sqrt{3} + i$ and hence represent in argand diagram.

8. Prove that $\lim\limits_{\theta \to 0} \left(\dfrac{\sin \theta}{\theta}\right) = 1$ where θ is in radian.

Question Paper Blue Print:

Course: ENGINEERING MATHEMATICS – I   **Course Code: 15SC01M**

UNIT NO		HOURS	Each questions to be set for 3 Marks Section - A	Each questions to be set for 5 Marks Section - B	Each questions to be set for 6 Marks Section- C	Weightage of Marks
1	a	2	2	-	-	31
	b	4	-	1	1	
	c	4	1	1	1	
2		8	2	3	1	27
3	a	6	1	-	1	14
	b	2	-	1	-	
4	a	8	1	1	1	47
	b	8	4	3	1	
5		4	1	-	1	9
6		6	2	1	1	17
TOTAL		52	14	11	08	145
Questions to be answered			10	08	05	100

Guidelines for Question Paper Setting:

1. The question paper must be prepared based on the blue print without changing the weigh age of model fixed for each unit.

2. The question paper pattern provided should be adhered to

   Section-A: 10 questions to be answered out of 14 questions each carrying 03 marks

   Section-B: 08 questions to be answered out of 11 questions each carrying 05 marks.

   Section-C: 05 questions to be answered out of 08 questions each carrying 06 marks.

3. Questions should not be set from the recapitulation topics.

4. Questions should not be set from the recapitulation topics.

Course Title: **ENGINEERING MATHEMATICS – I**	Course Code: **15SC01M**

UNIT-1: MATRICES AND DETERMINANTS

3 MARK QUESTIONS

1. If $A = \begin{bmatrix} 3 & -9 \\ -4 & 7 \end{bmatrix}$, find $A + A'$.

2. If $A = \begin{bmatrix} 2 & -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & -2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, find AB matrix.

3. If matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ 5 & 1 & 0 \\ 1 & 0 & x \end{bmatrix}$ is a singular matrix, then find the value of x.

4. Find the adjoint of the matrix $A = \begin{bmatrix} 4 & -5 \\ 3 & -2 \end{bmatrix}$.

5. If $A = \begin{bmatrix} 3 & -1 \\ 0 & -2 \end{bmatrix}$ find the characteristic equation.

5 MARK QUESTIONS

1. Solve the equations $x + y = 3, 2x + 3y = 8$ by Cramer's rule.

2. Solve for x, if $\begin{vmatrix} 1 & 5 & 7 \\ 2 & x & 14 \\ 3 & 1 & 2 \end{vmatrix} = 0$

3. Verify Cayley-Hamilton theorem if $A = \begin{bmatrix} 1 & 3 \\ 2 & -4 \end{bmatrix}$.

4. Verify $A(AdjA) = |A|.I.$ if $A = \begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$.

5. Find the adjoint of the matrix $A = \begin{bmatrix} 3 & -1 & 2 \\ 2 & -3 & 1 \\ 0 & 4 & 2 \end{bmatrix}$

6 MARK QUESTIONS

1. Solve for x &y from the equations $4x + y = 7, 3y + 4z = 5, 5x + 3z = 2$ by Cramer's rule.

2. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

3. Prove that adj(AB)=(adjB).(adjA) if $A = \begin{bmatrix} -1 & 0 \\ 5 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$

4. Find the characteristic roots of a matrix $\begin{bmatrix} 1 & -1 \\ -6 & -2 \end{bmatrix}$.

5. Solve the equations by Gauss elimination method $3x - y + z = 0, x + 2y - 2z = 3, 3x + z = 4$.

UNIT-2: VECTORS

3 MARK QUESTIONS

1. Find the magnitude of vector 2i +3j – 6k
2. If $\vec{a} = i + 2j - 3k, \vec{b} = 3i - 5j + 2k$ find magnitude of $\overrightarrow{3a} - \overrightarrow{2b}$
3. Show that $\cos\theta i - \sin\theta j$ is unit vector
4. Show that the vectors $2i + 5j - 6k$,and $7i + 2j + 4k$ orthogonal vectors.
5. If $\vec{a} = 5i + 2j - 4k$, and $\vec{b} = 2i - 5j + 3k$ find $\vec{a}X\vec{b}$.

5 MARK QUESTIONS

1. Find cosine of the angle between the vectors $4i - 2j - 3k$ and $2i - 3j + 4k$.
2. Find the projection of $\vec{b}$ on $\vec{a}$ if $\vec{a} = 5i + 2j - 4k$ and $\vec{b} = 2i - 5j + 6k$.
3. If $\vec{a} = 3i + 2j - 4k$ and $\vec{b} = i - 2j + 5k$ are two sides of a triangle, find its area.
4. Simplify $(\vec{a} + \vec{b}).(\vec{a} - \vec{b})$ and $(\vec{a} + \vec{b})X(\vec{a} - \vec{b})$.
5. Find the magnitude of moment of force $4i - 2j + 5k$ about (2,5,-7) acting at (4,7,0)

6 MARK QUESTIONS

1. If A=(2,5,7), B=(3,9,4) and C=(-2,5,7) are three vertices of parallelogram find its area.
2. If a force $4i + 6j + 2k$ acting on a body displaces it from (2,7,-8) to (3,9,4). Find the work done by the force.
3. Find the sine of the angle between the vectors $4i - 2j - 3k$ and $2i - 3j + 4k$.
4. Find the unit vector in the direction perpendicular to both vector $2i - 5j + k$ and $5i + j + 7k$.
5. Show that the points whose position vectors are $i - 3j - 5k, 2i - j + k$ and $3i - 4j - 4k$ form a right angled triangle.

UNIT-3: PROBABILITY AND LOGARITHMS

3 MARK QUESTIONS

1. Define equally likely events, Independent event, and mutually exclusive event.
2. Define probability of an event.
3. A coin is tossed twice. What is the probability that at least one head occurs.
4. A die is thrown once, what is the probability an odd number appears.
5. If E and F are events such that P(E)=0.6, P(F)=0.3 and P(E∩F)= 0.2. Find P(E/F).

5 MARK QUESTIONS

1. Prove that $\dfrac{1}{1+\log_c ab} + \dfrac{1}{1+\log_a bc} + \dfrac{1}{1+\log_b ca} = 1$
2. If $x = \log_c ab$, $y = \log_b bc$, $z = \log_a ca$,
   Prove that $xyz = x + y + z + 2$
3. If $x = \log_{2a} a$, $y = \log_{3a} 2a$, $z = \log_{4a} 3a$, prove that $xyz + 1 = 2yz$
4. If $a^2 + b^2 = 7ab$, prove that $\log\left(\dfrac{a+b}{3}\right) = \dfrac{1}{2}(\log a + \log b)$
5. Solve for x given that $(\log_2 x)^2 + (\log_2 x) - 20 = 0$

6 MARK QUESTIONS

1. An integer is chosen at random from the numbers ranging from 1 to 50 . What is the probability that the integer chosen is a multiple of 3 or 10 ?
2. Two unbiased dice are thrown once . Find the probability of getting the sum of the numbers obtained on the two dice is neither a multiple of 2 nor a multiple of 4 .
3. One card is drawn from a well shuffled pack of 52 cards. If E is the event "the card drawn is a king or an ace" and F is the event " the card drawn is an ace or a jack " then find the conditional probability of the event E, when the event F has already occurred .
4. A pair of dice is thrown once. If the two numbers appearing on them are different, find the probability that the sum of the numbers is 6.
5. A family has two children. What is the probability that both the children are boys given that (i) the youngest is a boy. (ii) at least one is a boy ?

UNIT-4: ALLIED ANGLES AND COMPOUND ANGLES

ALLIED ANGLES

3 MARKS QUESTIONS

1. Find the value of $\cos ec\left(-1110^{\,0}\right)$

2. Find the value of $\dfrac{\cos ec\left(180^{\,0} - A\right)\cos A}{\sec\left(180^{\,0} + A\right)\cos\left(90^{\,0} + A\right)}$

3. 3.If $\sin\theta = \dfrac{1}{2}$ and $\dfrac{\pi}{2} \subset \theta \subset \pi$, find $\cos\theta$

4. 4. If A+B+C $=180^0$ Prove that $\cot\left(\dfrac{A+B}{2}\right) = \tan c/2$

5. 5.find the value of $\tan\left(\dfrac{7\pi}{3}\right)$

5 MARKS QUESTIONS

1. Prove that $\dfrac{\sin(180^0 - A)\,COS(360^0 - A)\,\tan(180^0 + A)}{COS(270 + A)\,\sin(90 + A)\,\cot(270 - A)} = 1$

2. If secx = 13/5 and $270^0 \subset x \subset 360^0$, Find the value of $\dfrac{3\sin x - 2\cos x}{9\cos x + 4\sin x}$

3. Find the value of $\cos 570^0 \sin 510^0 - \sin 330^0 \cos 390^0$

4. Evaluate $\dfrac{\sin(-\alpha)}{\sin(90^0 + \alpha)} - \dfrac{\cos(-\alpha)}{\cos(90 - \alpha)} - \dfrac{\sec(90^0 - \alpha)}{\cos(180^0 + \alpha)}$

5. Show that $\tan 225^0 \text{x} \cot 405^0 + \tan 765^0 \text{x} \cot 675^0 + \text{cosec}135^0 \text{x} \sec 315^0 = 0$

6 MARK QUESTIONS

1. Evaluate $\tan 315^0 \text{x} \cot 405^0 + \tan 765^0 \text{x} \cot 675^0 + \text{cosec}135^0 \text{x} \sec 315^0$

2. Find x if $\dfrac{x \sin^2 300^0 \sec^2 240^0}{\cos 225^0 \cos ec^2 240^0} = \cot^2 315^0 \tan^2 300^0$

3. If $\sin\theta = \dfrac{-1}{4}$ and $\pi \subset \theta \subset \dfrac{3\pi}{2}$, find the value of $\dfrac{\cos\theta + \tan\theta}{\cot\theta + \sec\theta}$

4. Evaluate $\dfrac{\sin(2\pi - A)}{\sin(\pi - A)} - \dfrac{\tan\left(\dfrac{\pi}{2} + A\right)}{\cot(2\pi + A)} + \dfrac{\cos ec(-A)}{\sec\left(\dfrac{\pi}{2} + A\right)}$

5. Show that $\tan^2(315^0)\cot(-405^0) + \cot(495^0)\tan(-585^0) = 0$

COMPOUND ANGLES

3 MARKS QUESTIONS

1. Find the value of $\sin 15^0$

2. Show that $\tan(45^0 + \theta) = \dfrac{1 + \tan\theta}{1 - \tan\theta}$

3. Prove that $\dfrac{\sin(A - B)}{\cos A \cos B} + \dfrac{\sin(B - C)}{\cos B \cos C} + \dfrac{\sin(C - A)}{\cos C \cos A} = 0$

4. Using tan(A+B), prove that $\cot(A+B) = \dfrac{\cot A \cot B - 1}{\cot A + \cot B}$

5. Prove that $\dfrac{\sin 2A}{\sin A} - \dfrac{\cos 2A}{\cos A} = \sin A$

5 MARKS QUESTIONS

1. Prove that cos(A-B) cos(A+B)= cos²A-sin²B

2. Show that $\sin\left(A+\dfrac{\pi}{4}\right)+\cos\left(A+\dfrac{\pi}{4}\right)=\sqrt{2}\cos A$

3. If $\sin A=\dfrac{1}{\sqrt{10}}$, $\sin B=\dfrac{1}{\sqrt{5}}$ $provethat A+B=45^{0}$

4. Prove that $\tan 3\theta-\tan 2\theta-\tan\theta=\tan\theta\tan 2\theta\tan 3\theta$

5. If $A+B=\dfrac{\pi}{4}$, $provethat(1+\tan A)(1+\tan B))=2$

TRASFORMATION FORMULAE

3 MARKS QUESTIONS

1   P.T $\dfrac{\cos A+\cos B}{\sin A+\sin B}=\cot\left(\dfrac{A+B}{2}\right)$

2   P.T $\dfrac{\sin 68°+\sin 52°}{\cos 68°+\cos 52°}=\sqrt{3}$

3   Show that $\cos 40°-\cos 50°=\sqrt{2}\ \sin 5°$

4   Show that $\sin 47°+\cos 77°=\cos 17°$

5   Show that $\cos 80°+\cos 40°-\cos 20°=0$

MARKS QUESTIONS

1   P.T $\dfrac{\sin\theta+\sin 3\theta+\sin 5\theta}{\cos\theta+\cos 3\theta+\cos 5\theta}=\tan 3\theta$

2   In and triangle ABC prove that tanA + tanB +tanC = tanA tanB tanC

3   Show that $\dfrac{\sin 9°+\cos 9°}{\cos 9°-\sin 9°}=\tan 54°$

4   Prove that $\cos 55°+\cos 65°+\cos 175°=0$

5   Prove that $\sin 20°\times\sin 40°\times\sin 80°=\dfrac{\sqrt{3}}{8}$

MARKS QUESTIONS

1   Prove that cos20⁰xcos40⁰xcos80⁰xcos60⁰= 1/16

2   In any triangle ABC prove that sinA + sinB + sinC=4Cos(A/2)cos(B/2)cos(C/2)

3   Show that $\dfrac{\cos x+\cos 2x-\cos 3x-\cos 4x}{\sin x+\sin 2x+\sin 3x+\sin 4x}=\tan x$

4   If A+B+C = 180⁰ prove that $\cos^{2}A+\cos^{2}B+\cos^{2}C=1-2\cos A\cos B\cos C$

5   If A+B+C = 180^0 prove that sin2A-sin2B+sin2C=4cosAcosCsinB

UNIT-5: COMPLEX NUMBERS

3 MARK QUESTIONS

1. Evaluate i^{-999}
2. Find the complex conjugate of $(1 + 2i)(3i - 4)$
3. Express $(3 + 4i)^{-1}$ in the form a+ib
4. Find the real part and imaginary part of $\frac{1}{\sqrt{2} + i}$
5. $if x + iy = \cos \theta + i \sin \theta$ show that $x + \frac{1}{x} = 2 \cos \theta$

5 MARK QUESTIONS

1. Evaluate $\left(i^{19} + \left(\frac{1}{i}\right)^{25}\right)^2$
2. Find the modulus and amplitude of $\left(1 - i\sqrt{3}\right)$
3. Express in a + ib form: $\frac{(2+3i)}{(1+3i).(2+i)}$
4. Express the complex number 1 + i in the polar form.
5. Find the amplitude of $\sqrt{3} + i$ and represent in Argand diagram.

UNIT-6: INTRODUCTION TO CALCULUS

3 MARK QUESTIONS

1. Evaluate: $\lim\limits_{x \to -3} \frac{x^2 - 9}{x + 3}$
2. Evaluate: $\lim\limits_{\theta \to 0} \left(\frac{\tan m\theta}{\sin n\theta}\right)$
3. Evaluate: $\lim\limits_{n \to \infty} \left(\frac{n+1}{n}\right)^n$.
4. Evaluate: $\lim\limits_{x \to \infty} \left(\frac{3x^2 - 2x + 1}{2x^2 + 5x - 1}\right)$
5. Evaluate: $\lim\limits_{x \to 0} \left(\frac{1 - \cos 2x}{x^2}\right)$

5 MARK QUESTIONS

1. Evaluate: $\lim\limits_{x \to 1} \frac{x^2 + x - 2}{x^2 - 1}$.
2. Evaluate: $\lim\limits_{x \to 0} \left(\frac{\sqrt{a+x} - \sqrt{a-x}}{3x}\right)$
3. Evaluate: $\lim\limits_{x \to 1} \left(\frac{x^m - 1}{x^n - 1}\right)$

4. Evaluate: $\lim\limits_{\theta \to 0} \left(\dfrac{1 - \cos x + \tan^2 x}{x \sin x} \right)$

5. Evaluate: $\lim\limits_{x \to 0} \left(\dfrac{e^{ax} - e^{bx}}{x} \right)$.

6 MARK QUESTIONS

1. Prove that $\lim\limits_{\theta \to 0} \dfrac{\sin\theta}{\theta} = 1$, if θ is in "radian".

2. Evaluate: $\lim\limits_{x \to 0} \left(\dfrac{\sin \pi x}{x-1} \right)$

3. Evaluate: $\lim\limits_{n \to \infty} \left(\dfrac{(5-n^2)(n-2)}{(2n-3)(n+3)(5-n)} \right)$.

4. Evaluate: $\lim\limits_{x \to 1} \dfrac{x^2 - 5x + 4}{x^2 - 12x + 11}$.

5. Evaluate: $\lim\limits_{x \to 2} \left(\dfrac{x^2 - 4}{\sqrt{x+2} - \sqrt{3x-2}} \right)$

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Government of Karnataka
Department of Technical Education, Bengaluru

Course: ENGINEERING MATHEMATICS - I

Course code: 15SC01M

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1	Dr. D.S. Prakash	Asst. Director (LRDC)	DTE, Bengaluru
2	Dr.MokaShekhu, ,	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
3	Sri.Sathyanaraya Dixit,	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru
4	Sri. Guruprasad V	Lecturer (Selection Grade /Science)	APS Polytechnic, Somanahalli
5	Dr.RajasekharHeera,	Lecturer/Science,	Government Polytechnic, Gulbarga.

Curriculum Review committee

	Name	Designation	Institution
1	Dr.MokaShekhu, ,	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
2	Sri.Sathyanaraya Dixit,	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru

	Course Title: **WORK SHOP TECHNOLOGY**	Course Code: **15ME11T**
	Credits (L:T:P) : **4:0:0**	Core/Elective: **Core**
	Type of course: **Lecture**	Total Contact Hours: **52**
	CIE : **25** Marks	SEE : **100** Marks

Prerequisites: Enthusiasm to learn the subject.

COURSE OBJECTIVES

1. Appreciate the various materials available for manufacturing.
2. Gain the knowledge about manufacturing process for particular application.
3. Powder metallurgy application for various types of cutting tools.

COURSE OUTCOMES

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Identify the various materials for manufacturing process for a particular application.	*R/U/A*	1,2,3,4,6,10	10
CO2	Identify the manufacturing process for a particular application.	*R/U/A*	1,2,3,4,6,10	08
CO3	Select the various types of Fabrication Process for Mechanical applications.	*R/U/A*	1,2,3,4,6,10	10
CO4	Understand the Metal casting Techniques and basic structure of products.	*R/U/A*	1,2,3,4,6,10	10
CO5	Understand the various Sheet metal works in practice for production.	*R/U/A*	1,2,3,4,6,10	06
CO6	To know the application of powder metallurgy techniques in Engineering and specially in cutting tools area	*R/U/A*	1,2,3,4,6,10	08
			Total sessions	**52**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
WORK SHOP TECHNOLOGY	3	3	3	3	-	3	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE/

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	Materials for Manufacturing	10	05	20	05	30	21
2	Basic Manufacturing process	08	05	05	20	30	21
3	Basic Fabrication Process	10	05	10	15	30	21
4	Metal casting processes	10	05	10	10	25	17
5	Sheet metal processes	06	05	05	05	15	10
6	Powder metallurgy	08	05	05	05	15	10
	Total	52	30	55	60	145	100

Legend: R; Remember, U: Understand A: Application

<div align="center">**CONTENTS**</div>

UNIT: I	MATERIALS FOR MANUFACTURING	CONTACT HOURS: 10 Hours

Introduction of Engineering Materials- Classification, mechanical Properties of metals and uses of Ferrous Metals-Pig Iron, Cast Iron, Wrought Iron, steel, Classification of Steels according to Carbon content, Introduction to High speed Steels-18-4-1 HSS & uses. Introduction, Purposes and methods of Heat treatment -Annealing-Normalizing-Hardening-Tempering and Case Hardening-Properties and uses of Nonferrous metals- Aluminum, Copper,Lead,Tin,zinc,Magnesium,Nickel, Properties and uses of Plastics- Thermo plastics & Thermosetting-Properties and Uses of Ceramics , Composite Materials and uses.

UNIT: II	BASIC MANUFACTURING PROCESS	CONTACT HOURS: 08 Hours

Introduction to manufacturing processes- Mechanical working of metal – Introduction to Hot working and cold working of metals. - Hot Rolling and types-Three High, Four high rolls. Principle of Drawing, Deep drawing. Principle of Extrusion, Direct, Indirect and tube Extrusion. Introduction to Forging, Smith forging operations. .

UNIT: III	BASIC FABRICATION PROCESS	CONTACT HOURS:10 Hours

Introduction to Welding-Classification of welding- Principle of Arc welding, Gas welding. Types of Arc welding-MIG Welding, TIG Welding, Submerged arc welding. Principle of resistance welding – Spot, butt, seam Welding. -Welding Defects and remedies. Comparison of welding, soldering and Brazing.

UNIT: IV	METAL CASTING PROCESSES	CONTACT HOURS: 10 Hours

Introduction to metal castings, Use of patterns, Pattern materials, types of Patterns-single, Split, loose Piece, Sweep, Skeleton, gated Patterns - allowances – Types of Moulding sand and Properties. Concept of Cope, Drag, Runner, Riser & core. Permanent mould casting – Die casting, Slush Casting, Centrifugal casting, Name and brief explanation of Defects in Castings

UNIT: V	SHEET METAL PROCESSES	CONTACT HOURS:06 Hours

Introduction to Sheet Metal Work and Applications, metals used for Sheet Metal work, Standard Gauge numbers. Sheet metal operations-shearing, cutting off, Parting, blanking, Punching, notching, slitting, Lancing, Bending, Drawing and squeezing. Introduction to Press working- Types of presses- Power press and Ball or Fly press. Applications of presses.

UNIT:VI	POWDER METALLURGY	CONTACT HOURS: 08 Hours

Introduction to Powder Metallurgy –Manufacture of Metal Powders by Different Methods-Automization, reduction, Electrolysis and Shotting.Powder Metallurgy Process, Secondary Operations. Products of Powder Metallurgy. Advantages and Limitations of powder metallurgy.

TOTAL CONTACT HOURS:52

TEXT BOOKS:

1. *Elements of Workshop Technology* Vol-I Manufacturing Process edition-By Hajra Choudry

Reference:

1. *Manufacturing Technology -1* By P.C Sharma of S.CHAND Publications.
2. *Engineering Materials* by Er.R.K.RAJPUT of S.CHAND Publications
3. *Work shop technology* By R.S KHURMI & J.K GUPTA of S.CHAND & Co.Ltd

Course Delivery: The course will be delivered through lectures and presentations, suitable Videos

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE*	IA	Students	Three tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student Activity	05	Log of Activity	1,2,3,4,5,6
				Total	**25**		
	SEE*	End Exam		**End of the course**	**100**	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5&6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**WORKSHOP TECHNOLOGY**	20
	Year:	Course code: **15ME11T**	
Name of Course coordinator :		Units:__ CO's:____	

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

Questions for CIE and SEE will be designed to evaluate the various educational components such as:

1. Remembering and Understanding :   - 30% weightage
2. Applying the knowledge acquired from the course :   - 50 % weightage
3. Analysis :   - 10% weightage
4. Evaluation :   - 5% weightage
5. Creating new knowledge :   - 5% weightage

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR STUDENT ACTIVITY(5 Marks)

Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the Concerned faculty (Course Coordinator) for assessing the given activity.

Diploma in Mechanical Engineering

1 Semester
Course Title: WORK SHOP TECHNOLOGY

Time: 3 hrs   Max marks:100

1 Answer any SIX question from Part A

2. Answer any SEVEN full questions From Part B

Section A   5x6=   30

1. Name the different engineering materials with Examples.
2. Explain the following processes of heat treatment with applications
    a) Annealing   b) hardening
3. State the uses of manufacturing process.
4. Explain common forging operations.
5) Explain with a neat sketch Tube Extrusion.
6) Define Welding and Classify.
7) Explain with neat sketch MIG welding
8) List the differences between Sand casting and Die casting.
9) Sketch and show the basic steps involved in powder metallurgy process.

Section B   10x7=70

10 a) Explain briefly Ductility & Malleability property of metal
   b) Explain use of composite materials in engineering.
11 a) Explain Thermo plastics & thermosetting.
   b) Differentiate between Pig Iron And Cast Iron.
12) Explain with neat sketch the following extrusions
 a) Direct Extrusion.
   b) Indirect Extrusion.
13) a) Explain with a neat sketch three high rolling.
   b) Name different metals used for sheet metal work.
14) Explain with sketch Gas welding and mention its advantages.
15) Explain with neat sketch
 a) Split pattern
   b) Gated pattern
16) a) Explain briefly manufacture of metal powder by Reduction method.
   b) Name the different products of powder metallurgy.
17) a) Differentiate between welding & Soldering.
   b) Compare MIG welding & TIG Welding.
18) a) Explain briefly Runner and Raiser used in casting process.
   b) Explain briefly any five defects in casting
19) a) Explain Gauges of sheet metal.
   b) Sketch Ball press neatly and labels its parts.

Diploma in Mechanical Engineering

1St Semester

Course Title: WORK SHOP TECHNOLOGY

CO 1: IDENTIFY THE VARIOUS MATERIALS FOR   MANUFACTURING PROCESS FOR A PARTICULAR APPLICATION

Remember

3. Define Engineering Materials? List any four important applications of them.
4. Name the different engineering materials with Examples.
5. State plasticity & Elasticity of metals.
6. List any five properties and uses of Cast Iron.
7. State five uses and Properties of Wrought Iron.
8. Define Heat treatment? And Indicate Any Four purpose
9. Name the Different Heat treatment Process?
10. Define Non Ferrous metal and Name any four Non ferrous metals.
11. State any five properties of Non ferrous metals.
12. State any five uses of Non ferrous metals.
13. State any five properties and uses of aluminium.
14. State any five properties and uses of copper.
15. State any five uses of nickel.
16. State any five properties and uses of Plastics.
17. State any five uses & properties of Ceramics.
18. Define composite materials. Indicate any four uses of them.
19. State any five uses of Cast Iron.
20. State any four uses of wrought Iron
21. State the Differences between Ferrous & Non Ferrous Metals.
22. State any four Examples for ferrous & non ferrous metals
23. State the five properties and uses of plastics.
24. State the five properties and uses of Ceramics

Understanding

25. Classify the engineering Materials with Examples.
26. Explain briefly Ductility & Malleability property of metal
27. Explain plasticity & Elasticity of metals.
28. Explain Annealing process in heat treatment.
29. Explain Normalizing Process.
30. Explain Hardening Process of   heat treatment.
31. Explain Tempering Process of Heat treatment.

32. Explain Case Hardening Process of heat treatment.
33. Explain Thermo plastics & thermosetting.
34. Differentiate between Pig Iron And Cast Iron.
35. Distinguish wrought Iron With steel
36. Indicate Five Properties and uses of Pig Iron.
37. Explain the following processes of heat treatment with applications
       a) Annealing   b) hardening
36. Explain the following processes of heat treatment with applications
       a) Normalizing .   b) Tempering.
37. Compare thermoplastics and thermosetting
38. Explain use of composite materials in engineering.

   Application
 38. Explain Annealing process in heat treatment.
 39. Explain Normalizing Process.
 40. Explain Hardening Process of heat treatment.
 41. Explain Tempering Process of Heat treatment.
 42. Explain Case Hardening Process of heat treatment.
 43. Explain Thermo plastics & thermosetting.
 44. Explain the following processes of heat treatment with applications
     a) Annealing   b) hardening
43. Explain the following processes of heat treatment with applications
       a) Normalizing .   b) Tempering.
44. Explain use of composite materials in engineering.
45. Write short notes ceramics.

1. CO 2: IDENTIFY THE MANUFACTURING PROCESS FOR A PARTICULAR APPLICATION

   Remember

 1) Define Forging. List the common forging operations.
 2) Define Rolling operation. List the types of rolling
 3) Define Extrusion. State the uses of it.
 4) State the uses of manufacturing process.
 5) Describe the uses of hot working & cold working.

   Understand

1)Explain hot working and cold working of metals.
2)Explain the Principle of wire drawing operation.
3)Explain common forging operations.
4)Compare hot working with cold working
Application
1)Explain hot working and cold working of metals.

2)Explain with a neat sketch three high rolling.
3)Explain with a neat sketch four high rolling.
4)Explain with a neat sketch Direct Extrusion.
5)Explain with a neat sketch Indirect Extrusion.
6)Explain with neat sketch Tube Extrusion.
7)Explain with a neat sketch Tube Extrusion.
8)Explain with neat sketch the following extrusions
    a) Direct Extrusion.
    b) Indirect Extrusion.
9)Explain with neat sketch following Rolling operations
    a) Three high Rolling
    b) Four High Rolling
10) Explain with neat sketch
    a) Indirect Extrusion
    b) Three high rolling

CO3: SELECT THE VARIOUS TYPES OF FABRICATION PROCESS FOR MECHANICAL APPLICATIONS.

Remember
1) Define Welding and Classify.
2) State the Differences between Arc welding & Gas welding.
3) List the welding defects.
4) State three uses of Arc welding
5) List any three uses of Gas welding.
6) Name the different types of Resistance Welding.
7) Define Soldering and classify
8) List the equipments used for Arc welding.
9) Define Welding and Classify.
10) State the Differences between Arc welding & Gas welding.
11) List the welding defects.
12) Explain with neat sketch MIG welding.
13) State three uses of Arc welding
14) List any three uses of Gas welding.
15) Name the different types of Resistance Welding.
16) List the equipments used for Arc welding.
Understanding
          17).Explain with neat sketch MIG welding.
18)Differentiate between welding & Soldering.
19) Differentiate between Brazing & Soldering.
20)Compare welding with soldering.
21) Explain briefly Soldering.
22)Compare MIG welding & TIG Welding.
Application:
23)Explain with neat sketch MIG welding.
24)Explain with neat sketch TIG welding.
25)Explain with sketch arc welding.
26)Explain with neat sketch Gas welding.

27)Explain with neat sketch Spot welding.
28)Explain briefly with sketches
    a) Spot welding
    b) Seam welding
29)Explain with neat sketch butt welding.
30)Explain with neat sketch Submerged arc welding.
31)Explain with neat sketch MIG welding.
32)Explain with neat sketch TIG welding.

CO4: UNDERSTAND THE METAL CASTING TECHNIQUES AND BASIC STRUCTURE OF PRODUCTS.

Remember
 1) Define metal Casting process.
 2) Define Pattern. List the materials used for Pattern.
 3) Name the different types of patterns.
 4) State the properties of moulding sand.
 5) list defects in casting
 6) state the importance of metal casting.
 7) State the Ingredients of Foundry Sand
 8) List the differences between Sand casting and Die casting.
 9) State the uses of metal casting
Understanding
 10)Explain metal Casting process.
 11)Explain briefly Runner and Raiser used in casting process.
 12)Explain briefly any five defects in casting
 13)Explain briefly Cope, Drag and Core used in casting process
 14)Explain pattern making materials
 15)Explain casting allowance

Application
1)Explain with sketch Split pattern.
2)Explain with sketch loose pattern.
3)Explain with sketch gated pattern.
4)Explain with sketch sweep pattern.
5)Explain with sketch slush Casting.
6)Explain briefly with a neat sketch centrifugal casting.
7)Explain with sketch slush Casting.
8)Explain with neat sketch centrifugal casting
9)Explain with neat sketch
        a) Split pattern
        b) Gated pattern
10)Explain with neat sketch die casting

CO5: UNDERSTAND THE VARIOUS SHEET METAL WORKS IN PRACTICE FOR PRODUCTION.

Remember
1) State the uses of sheet metal in Engineering
2) Describe properties and Gauges of sheet metal.
3) Name different metals used for sheet metal work.
4) State any Four applications of sheet metals
5) State any three applications of presses
6) State any three applications of presses

Understanding
1)Explain properties and Gauges of sheet metal.
2)Explain shearing and bending operation of sheet metals.
3)Explain briefly squeezing and blanking operation of sheet metal
4)) Explain following shearing operation in sheet metal
    a) Cutting off   b) Blanking
        Application
1)Explain briefly with sketch drawing operation of sheet metal.
2)Explain with necessary sketches of different Shearing operations in sheet metals.
3)Explain with sketch the following sheet metal operations
a) Bending   b) Drawing
 4) Explain Power press with a neat sketch
5) Explain Ball or fly press with a neat sketch
6)Sketch Ball press neatly and labels its parts.

CO6: TO KNOW THE APPLICATION OF POWDER METALLURGY TECHNIQUES IN ENGINEERING AND SPECIALLY IN CUTTING TOOLS AREA

Remember
 1)List the uses of powder metallurgy in engineering.
2) State any five Limitations of powder metallurgy.
3) State any five advantages of powder metallurgy.
4) Define metal powder. And name the different methods of manufacture.
5)Indicate the dis-advantages of powder metallurgy.
 6)Name the different products of powder metallurgy.
7)State the advantages & limitations of powder metallurgy.
8)Name the different methods used for metal powder.

Understanding
1). Explain the uses of powder metallurgy in engineering.
2)Explain briefly manufacture of metal powder by mechanical method.

3) Explain briefly manufacture of metal powder by Automization method.
4) Explain briefly manufacture of metal powder by Reduction method.
5) Explain briefly manufacture of metal powder by Electrolysis method.
6) Explain briefly manufacture of metal powder by shotting method.
7)Explain secondary operations of powder metallurgy process.
8)Explain the following metal powder manufacturing methods.
      a) Mechanical method   b) Automization
9)Explain the following metal powder manufacturing methods.
      a) Reduction method b) Electrolysis

Application

1) Explain with neat sketch powder metallurgy process
2) Explain the following metal powder manufacturing methods with sketch.
   a) Mechanical method   b) Automization
3)Explain the following metal powder manufacturing methods.
   a) Reduction method b) Electrolysis
4)Explain basic steps involved powder metallurgy with diagram.

Course Title: **ENGINEERING GRAPHICS-I**	Course Code: 15ME12D
Credits (L:T:P) : **0:2:4**	Core/ Elective: **Core**
Type of course: **Lectures & Practice**	Total Contact Hours: **78**
CIE- 25 Marks	SEE – 100 Marks

(***(Common to all Mechanical /AE/MTT/Chemical /Metallurgy Programme)***
Prerequisites: Zeal to learn the subject

Course Objectives:

1. The course is aimed at developing Basic Graphic skills.
2. Develop Skills In Preparation Of Basic Drawings.
3. Skills in Reading and Interpretation of Engineering Drawings.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

Course Outcome		CL	Linked units	Linked PO	Teaching Hrs
CO1	Use the drawing instruments effectively and able to dimension the given figures	*U/A*	1	1,2,3,9,10	**12**
CO2	Appreciate the usage of engineering curves in tracing the paths of simple machine components	*U/A*	2	1,2,3,9,10	**18**
CO3	Understand the concept of projection and acquire visualization skills, projection of points	*A*	3	1,2,3,9,10	**12**
CO 4	Able to draw the basic views related to projections of Lines, Planes	*A*	4,5	1,2,3,9,10	**36**
			Total sessions		**78**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
ENGINEERING GRAPHICS-I	**3**	**3**	**3**	-	-	-	-	-	**3**	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.
METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF >40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
IF < 5% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS CONSIDERED NOT-ADDRESSED.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks weightage	weightage (%)
			R	U	A		
1	DIMENSIONING	12	--	05	10	15	10
2	CONIC SECTIONS AND SPECIAL CURVES	18	--	10	30	40	28
3	ORTHOGRAPHIC PROJECTION AND PROJECTION OF POINTS	12	--	-	15	15	10
4	PROJECTION OF LINES	18	---	-	30	30	21
5	PROJECTIONS OF PLANE SURFACES	18	---	-	45	45	31
	Total	78		15	130	145	100

Legend: R; Remember, U: Understand A: Application

COURSE CONTENT

UNITI: DIMENSIONING   (12 Hours)

Introduction to Engineering Drawing-Drawing Instruments – Standard Sizes of Drawing sheets-Layout of drawing sheets-Types of lines and their applications-Conventions for various materials-Introduction to Dimensioning-Elements of Dimensioning–Systems of Dimensioning-Methods of arrangements of Dimensioning- Dimensioning of common features like diameters, radii, arcs and chords- Dimensioning of counter sunk and counter bore-Introduction to Scale- Definition of R.F- Concept of reducing, enlarging and full size scale.

UNITII:CONIC SECTIONS AND SPECIAL CURVES   (18 Hours)

Introduction to conic sections -Division of a line into equal number of parts- Types of conic section- Eccentricity- Construction of conic sections(Parabola, Ellipse and Hyperbola) when eccentricity and distance of the focus from the directrix is given-Construction of ellipse by Intersecting lines method(Rectangular and parallelogram methods)and Concentric circles method -Construction of parabola by rectangle method, parallelogram method and a tangent method-Construction of Rectangular/Equilateral Hyperbola-Construction of Involutes of a circle and to draw tangent and normal at any point on the curve- Construction of Cycloid and to draw a tangent and normal at any point on the curve.

UNITIII: ORTHOGRAPHIC PROJECTIONAND PROJECTION OF POINTS(12Hours)

Introduction to orthographic projection- Principal planes of projection- Four Quadrants- Concept of First angle &Third angle projection methods- Projection of points in all the four quadrants.

UNIT IV: PROJECTION OF LINES **(18 Hours)**

Projection of lines – Line Parallel to both HP and VP –Line parallel to one plane and Perpendicular to other- Line parallel to one plane and Inclined to the other- Line inclined to both HP and VP. **(First angle projection should be followed).**

UNIT V: PROJECTION OF PLANE SURFACES **(18Hours)**

Construction of polygons-Projection of plane Surfaces–Plane surface parallel to one plane and Perpendicular toother two–Plane surface Perpendicular to one plane and inclined to the other- Plane surface inclined to both HP and VP.

Total Contact Hours: 78

TEXT BOOK

1.K.R.Gopalakrishna"Fundamentalsof Drawing" Subhas Publications, 2010.
2.K.R.Gopalakrishna"Engineering Drawing" (Vol. I & II), Subhas Publications, 2014.

REFERENCES

1. R.K. Dhawan, "A text book of Engineering Drawing", S. Chand Publishers, Delhi,2010.
2.G.S. Phull and H.S.Sandhu, "Engineering Graphics", Wiley Publications, 2014.
3. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Private Limited, 2008.
4. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, 2005..
5. DhananjayA.Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, 2008.
6. BasantAgarwal and Agarwal.C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct method / **Assessment**	CIE*	IA	Students	Graded Exercises (Average marks of each graded exercise to be considered)	25	Drawing Sheets	1,2,3,4
	SEE*	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 ,Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

NOTE:THIS SUBJECT SHOULD THOUGHT IN A BATCH OF 15 TO 20 STUDENTS. FACULTY INCHARGE PER BATCH HAS TO MONITER, EVALUATE OR ASSESS THE STUDENTS.

Diploma in Mechanical Engineering
1st semester
Course title: **Engineering Graphics-I (Conventional)**
Time; 4 Hrs.   **Max. marks: 100**
Note: Part –A is compulsory. Answer ANY TWO full questions from Part-B,C& D

Part –A
1.(a)List the standard sizes of the drawing sheets.   -- 05
   (b)Mention the types of lines and their applications.   --05

Part –B
1.Draw an ellipse when the distance of focus from the directrix is 40and Eccentricity is ¾.-15

2.A Stone thrown from the ground level reaches a maximum height of 45 metre and
falls on the ground at a distance of 100metre from the point of projection. Trace the
path of the stone in space. Select a scale of 1:1000   ---15

3.Draw the involute of a circle of diameter 50mm . Also draw a tangent and normal   ---15
at any point on the curve.

PART- C

1. Draw the projections of the following points on a common reference line:
a)Point P is 25mm above the HP and 40mm behind the VP
b)Point Q is 30mm below the HP and 40mm behind the VP
c) Point R is 25mm above the HP and in the VP.
d)Point S is 30mm below the HP and in the VP
e)Point T is 35mm in front of the VP and in the HP.
                                     --- 15
2. A line AB measuring 70mm has its end A is 15mm in front of VP and 20mm above HP.
And the other end B is 60mm in front of VP and 50mm above HP.
Draw the projections of the line and find the Inclinations of the line with both the reference
planes of projection.
               --- 15
3.A line PQ has its end P 15mm above HP and 10mm in front of VP. The end Q is 55mm above
HP and the line is inclined at 30° to HP. The distance between the end projectors
of the line. When measured parallel to the line of intersection of HP and VP is 50mm.
Draw the Projections of line and find its inclination with VP.   ---15

PART-D

1.Apentagonal plane lamina of edges 20mm is resting on HP with one of its corners touching it such that the plane surface makes an angle of 60° with HP. The two of the base edges containing the corner on which the lamina rests make equal inclination with HP. If the edge opposite to this corner makes an angle of 45° with the VP. Draw the top and front views of the plane lamina in this position.   --15

2. A equilateral triangular lamina of 30mm side lies with one of its edges on HP such that The surface of the lamina is inclined to the HP at 60°. The edge on which it rests is inclined to the VP at 60°. Draw the projections.   --15

3. A circular lamina of 60mm diameter rests on HP such that the surface of the lamina is inclined at   30° to HP. The diameter through which the point on which the lamina rests on HP appears to be inclined at 30° to VP in the top view. Obtain its projections.   --15
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MODEL QUESTION BANK
Diploma in Mechanical Engineering
1ST semester
Course title: Engineering Graphics-I (Conventional)

CO 1: USE THE DRAWING INSTRUMENTS EFFECTIVELY AND ABLE TO DIMENSION THE GIVEN FIGURES

LEVEL:UNDERSTANDING

10 Marks Questions (Each sub questions carries 5 marks)

1. (a)List the standard sizes of drawing sheets.
   (b)Mention the types of lines and their applications.

2. a) Illustrate the elements of dimensioning with the help of a sketch.
   b) Illustrate the dimensioning of given common features: diameter, radius, chord, Arc and angle.

3. a)Mention the uses of the following drawing instruments.
   i) T-square ii) Set square   iii)Bow compass iv) Clinograph   v)Minidrafter
   b) Mention the uses of the following drawing instruments.
   i) French curves ii) Protractor   iii) Clips iv)Erasing Shield   v)Drafting machine

4. a) Define RF. Mention the types of scales based on RF.
   b) Give the conventional representation for the following materials.
   i) Cast iron   ii) Lead   iii)Bronze   iv)Glass   v)Wood

5. a) Illustrate the dimensioning of counter sunk and counter bore
   b)Draw the standard layout of aA2 size drawing sheet

1. List the standard sizes of drawing sheets.
2. Mention the types of lines and their applications.
3. Illustrate the elements of dimensioning with the help of a sketch.
4. Illustrate the dimensioning of given common features: diameter, radius, chord, Arc and angle.
5. Mention the uses of the following drawing instruments.
i) T-square ii) Set square   iii) Bow compass iv) Clinograph   v) Minidrafter
6. Mention the uses of the following drawing instruments.
i) French curves ii) Protractor   iii) Clips iv)Erasing Shield   v) Drafting machine
7.Draw the standard layout of aA2 size drawing sheet

LEVEL:APPLICATION

8. Copy the given sketch to 1:1 scale and dimension adopting aligned system with parallel dimensioning method.
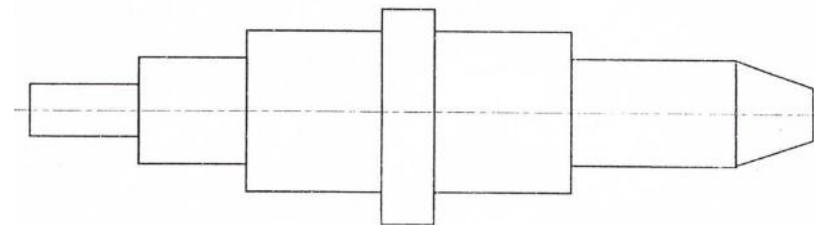
9. Copy the given sketch to 1:1 scale and dimension adopting aligned system with progressive dimensioning method.
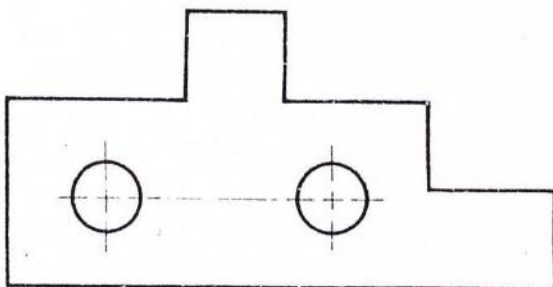
10. Copy the given sketch to 1:1 scale and dimension adopting unidirectional system with chain dimensioning method.
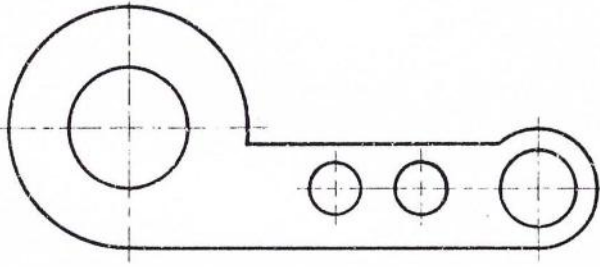
11. Copy the given sketch to 1:1 scale and dimension adopting unidirectional system with combined dimensioning method.
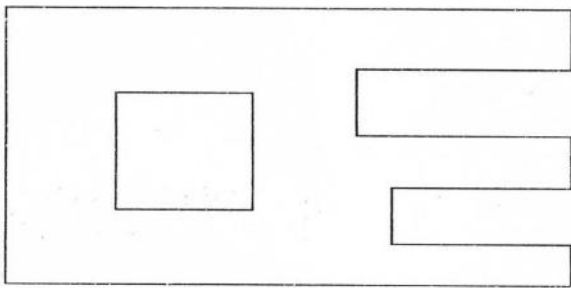
12. Copy the given sketch to 1:1 scale and dimension adopting unidirectional system with parallel dimensioning method.
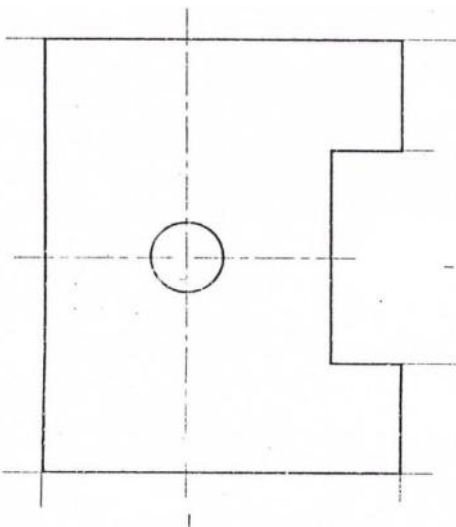
13. Copy the given sketch to 1:1 scale and dimension adopting aligned system with chain dimensioning method.
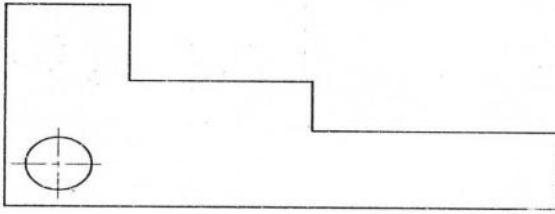
LEVEL:UNDERSTANDING

10 Marks Questions

1. Inscribe an ellipse in a rectangle of 130x80mm by intersecting lines method.
2. A parallelogram has sides 130mm and 80mm at an included angle of 60°. Inscribe an ellipse In the parallelogram. Find the major and minor axes of the ellipse.
3. Draw a parabola when the distance of the focus from the directrix is 30mm.
4. Construct a Parabola in a parallelogram of the sides 100mmx45mm and with an included angle of 75°.

LEVEL:APPLICATION

15Marks Questions

5. A Stone thrown from the ground level reaches a maximum height of 45 meter and falls on the ground at a distance of 100metre from the point of projection. Trace the path of the stone in space. Select a scale of 1:1000

6. A shot is discharged from the ground level at an inclination of 55° to the ground which is assumed to be horizontal. The shot returns to the ground at a point 75metre distant from the point of discharge. Trace the path of the shot. Scale 1:1000. Use tangent method only.

7. Draw an ellipse when the distance of focus from the directrix is 40 mm &eccentricity is ¾.
8. An ellipse has the major axis and minor axis in the ratio 3:2. Draw the ellipse when the major is axis is 135mm by concentric circles Method.
9. Construct a hyperbola when the distance of focus from the directrix is 35 mm and eccentricity is 4/3.
10. Construct a rectangular hyperbola given a point P on it at a distance of 20 mm and 15 mm from the two asymptotes.
11. Draw the involute of a circle of diameter 40 mm. Also draw a tangent and normal at any point on the curve.
12. A circle of 50 mm diameter rolls on a line. A point on the circumference of the circle is in

Contact with the line in the beginning and after one complete revolution. Draw the cycloidal path of the point. Draw a tangent and normal at any point on the curve.

LEVEL:APPLICATION

(15Marks Questions)

1. a) Draw the symbolic representation of First angle projection method.
    b) Draw the projections of the following points:
          i)   P is 25mm below the HP and in the VP
    ii) Q is 40mm behind the VP and in the HP
        iii) R is 30mm below the HP and 30mm in front of the VP
        iv) S is 25mm above the HP and 25mm behind the VP

2. a) Draw the symbolic representation of Third angle projection method.
    b)Draw the projections of the following points:
    i)   T is 25mm above the HP and 30mm in front of the VP.
        ii) U is in both the VP and HP
        iii) V is 35mm below the HP and 30mmm behind the VP
        iv) W is 30mm above the HP and 35mm behind the VP

3. a) Draw the projections of the following points:

        i)A is 25mm above the HP and 35mm in front of the VP
        ii)B is 25mm above the HP and 40mm behind the VP
        iii)C is 30mm below the HP and 40mm behind the VP
        iv)D is 30mm below the HP and 35mm in front of the VP
        v)E is 25mm above the HP and in the VP.
        vi) F is 30mm below the HP and in the VP
        vii)G is 35mm in front of the VP and in the HP
        viii)H is 40mm behind the VP and in the HP
        ix)M lies in all the three principal planes

4. a) A point P is 40 mm in front of VP, 50 mm above HP and 30 mm in front of left PP. Draw the three principal views of the point.
    b) A point P is 30 mm above HP, 50 mm behind VP and 45 mm in front of left PP. Draw the three principal views of the point

5. a) Draw the three principal views of a point P lying 40 mm behind VP, 60 mm below HP and 30 mm behind the right PP
    b)Draw the three principal views of a point P lying 60 mm below HP, 50 mm in front of VP and 45 mm in front of the left PP.

LEVEL:APPLICATION

(15Marks Questions)

1.a)Draw the three principal views of a line 80 mm long placed parallel to VP and perpendicular to HP. The line is 70mm in front of VP and 60mm in front of right PP. The lower end of the line is 30mm above HP.

b) Draw the three principal views of a line 80 mm long when it is placed parallel toboth HP & VP. One of the ends of the line is 70 mm above HP, 60 mm in front of VP and 30mm in front of the right PP.

2. a) A line AB 80 mm long is inclined at 30° to HP and parallel to VP. The line is 90 mm in front of VP. The lower end A is 35 mm above HP,110 mm in front of the right PP and is away from it than the higher end. Draw the three principal views of the line.

b) A line AB 80 mm long is inclined at 45° to VP and parallel to HP. The end nearer to VP is 30mm in front of VP, 60 mm above HP and 100 mm in front of right PP. Draw the three principal views of the line.

3. a) Draw the projections of a line AB, 80 mm long inclined at 30° to HP and parallel to VP. The line is 40 mm in front of VP. The lower end A is 20 mm above HP.

b) The length of a line is 100 mm long and is inclined at 45° to VP and parallel to HP.The line is 15 mm above HP and one end of the line is 10 mm in front of VP. Draw the projections of the line and measure top and front views.

4.a)The length of top view of a line which is parallel to VP and inclined at 45° to HP is 50 mm. One end of the line is 12 mm above HP and 25 mm in front of 45° to VP. Draw the projections of the line and determine its true length.

b) Draw the projections of a line 70 mm long lying in VP and inclined at 45° to HP. The lower end of the line is 10 mm above HP.

5. A straight line AB, 80 mm long makes an angle of 45° to HP and 30° to VP. The end A is 10 mm in front of VP and is on HP. Draw the projections of the line.

6.A line AB 60 mm long has one of its extremities 20 mm in front of VP and 15 mm above HP. The line is inclined at 30° to HP and 45° to VP. Draw its top and front views.

7.A line AB is 75 mm long. The end A is touching VP and 10 mm above HP. The end B is 50 mm in front of VP and 30 mm above HP. Draw the top view of the line AB and finds the true inclinations of the line AB with HP & VP.

8.A line AB measuring 70 mm has its end A 15 mm in front of VP and 20 mm above HP. The other end B is 60 mm in front of VP and 50 mm above HP. Draw the projections of the line with HP & VP.

9.A line PQ has its end P 15 mm above HP and mm in front of VP. The end Q is 55 mm above HP and the line is inclined at 30° to HP. The distance between the end projectors of the line when measured parallel to the line of intersection of HP & VP is 50 mm. Draw the projections of the line and find its inclinations with VP.

10.The distance between the end projectors passing through the end points of a line AB is 40 mm. The end A is 20 mm above HP and 15 mm in front of VP. The line AB appears as 65 mm long in the front view. Complete the projections. Find the true length of the line and its inclinations with HP & VP.

11. The top view of a line PQ, 75 mm long measures 50 mm. The end P is 50 mm in front of VP and 15 mm above HP. The end Q is 15 mm in front of VP. Draw the projections of the line PQ and fine its inclinations with HP & VP.

12.The front view of a line is 80 mm in length and makes 40° with XY line. One of its ends is 10 mm in front of VP and 15 mm above HP. The other end is 50 mm in front of VP. Draw the top and front views of the line. Determine the true length and inclinations of the line with HP & VP.

13.The front view of a line AB, 125 mm long, is 75 mm and its top view is 100 mm long. Its end A is 30 mm from both the planes of projection. Draw the projections and find the inclinations of the line with the reference planes of projection.

14.Line measuring 75 mmlong has one of its ends 50mm in front of VP and 15mm above HP. The top view of the line is 50mm long. The other end is 15mm in front of VP and above HP. Draw the projections of the line and find the true inclination.

CO 5: ABLE TO DRAW THE BASIC VIEWS RELATED TO PROJECTIONS OF PLANES

(15Marks Questions)

1. An equilateral triangular lamina of side 40mm rests with one its sides on HP so that the surface of the lamina is inclined at 30° to HP. The side on which the lamina rests is inclined at 45° to VP. Draw the projections of the lamina.
2. An equilateral triangular lamina of sides 30mm is resting with one of its corners on HP, The surface of the lamina is inclined at 45° to HP and the side opposite to the corner on which the lamina rests is inclined at 45° to VP. Draw the projections of the lamina.

3. A square lamina of 40mm side rests with one of its sides on HP so that the surface of the lamina is inclined at 30° to HP. The side on which the lamina rests is inclined at 45° to VP. Draw the top and front views of the square lamina in this position.

4. A square lamina of 40mm sides rests with one of its corner on HP. The diagonal passing through this corner is inclined at 45° to HP and appears to be inclined at 45° to VP. Draw its projections.

5. A square lamina of side 40mm rests with one of its corner on HP. The diagonal passing through this corner is inclined at 45° to HP and 30° to VP. Draw its projections.

6. A regular pentagonal lamina has its sides as 30mm. It is resting with one of its corners on HP so that the side opposite to this corner touches VP. The plane surface of the lamina is inclined at 30° to HP.

7. A hexagonal lamina of sides 30mm rests on one of its sides on HP so that the surface of the lamina is inclined at 45° to HP. The side parallel to the side on which the lamina rests is inclined at 45° to VP. Draw the top and front views of the lamina.

8. A hexagonal lamina of side 30mm is resting with one of its corner on HP so that the diagonal passing through that corner is inclined at an angle of 45° and appears to be inclined at 30° to VP. Draw the top and front views of the lamina.

9. A square lamina of ABCD of 30mm side rests on the corner C such that diagonal AC appears as at 30° to the VP in the top view. The two sides BC and CD containing the corner C make equal inclinations with the HP. The surface of the lamina makes 45° with HP. Draw its top and front views.

10. A pentagonal plane lamina of edges 20mm is resting on HP with one of its corner touching it such that plane surface makes an angle of 60° with HP. The two of the base edges containing the corner on which the lamina rests make equal inclinations with HP. If the edge opposite to this corner makes an angle of 45° with the VP. Draw the top and front views of the plane lamina in this position.

11. A hexagonal lamina of 30mm sides rests on HP on one of its sides. The side which is on HP is perpendicular to VP and the surface of the lamina is inclined to HP at 45°.
The lamina is then rotated through 90° such that the side on HP is parallel to the VP, while the surface is still inclined to HP at 45°. Draw the front view and the top view of the lamina in its final position.

12. A circular lamina of 60mm diameter rests on HP such that the surface of the lamina is inclined at 30° to HP. The diameter through the point on which the lamina rests on HP appears to be inclined at 30° to the VP in the top view. Obtain its projections.

Course Title: **Basic Computer Skills Lab**	Course Code: 15ME13P
Credits (L:T:P) : **0:2:4**	Core/ Elective: **Core**
Type of course: **Tutorial, Practice**	Total Contact Hours: **78**
CIE- 25 Marks	SEE-50 Marks

Prerequisites: Knowledge of English comprehension.

COURSE OBJECTIVES

Will learn and understand the Basics of Computers and apply the application tools like word processor, spread sheet and presentation.

COURSE OUTCOMES

On successful completion of the course, the students will be able to attain CO:

Course Outcome		CL	Experiments linked	Linked PO	Teaching Hrs
CO1	Understand the basic organization of the computer.	*R/U/A*	1and 2 of Unit-1	1,2,3,4,8,9,10	**03**
CO2	Use the different tools and utilities of the operating system.	*R/U/A*	3 to 7 of Unit-1	1,2,3,4,8,9,10	**18**
CO3	Demonstrate specified skills of using word processor module.	*R/U/A*	1 to 6 of word processor part of Unit-2	1,2,3,4,8,9,10	**18**
CO4	Demonstrate specified skills of using word spread sheet module	*R/U/A*	1 to 5 of spread sheets part of Unit-2	1,2,3,4,8,9,10	**18**
C05	Demonstrate specified skills of using presentation module.	*R/U/A*	1 to 3 of presentation part of Unit-2	1,2,3,4,8,9,10	**09**
C06	Utilize the concepts learned to create a mini project.	U/A	Contents mini project part of Unit2	All ten	12
			Total sessions		**78**

COURSE PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Basic Computer Skills Lab	3	3	3	3	1	1	1	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq$40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENTS

Tutorials and Practice

Unit – I

Introduction to computer hardware and software
1. Identify and understand the models of Computers, Identify and understand front panel and back panel connections of a Computer system, Identify and understand the physical components of a Computer.
2. Conduct computer system connection and understand the booting process.
3. Familiarization of GUI based Operating System environment.
4. Practice creating Icons and Folders, Creating/Opening of file, Editing and saving the document, Copy, Cut and Paste operations, in-built utilities of OS like – Text editors, paint, calculator, etc.
5. Practice browsing of different sites using search engine.
6. Practice Creating E-Mail accounts, E-Mail Group, Sending, and Receiving of E-Mails.

Unit –II

Word Processing
1. Create a Business Letter and Personal Letter.
2. Create a Company Letterhead.
3. Create a Simple Newsletter with minimum three columns. Insert a Clip art in the newsletter.
4. Create a Resume for a Job Application.
5. Create the cover page of a Project Report(use Word Art, insert Picture Image).
6. Prepare the class time table for your class.

Spreadsheet
1. Create a worksheet with five columns. Enter ten records and find the sum of all columns using autosum feature.
2. You have a monthly income of Rs.11000. Your monthly expenditures are Rent- Rs 3500, Food- Rs. 1500, Electricity- Rs.110, Phone- Rs. 160, and Cable TV-Rs. 300. Prepare a worksheet with the Monthly Income, the Monthly Expenditures listed and summed, monthly savings amount (what's left over each month) calculated, and the amount saved per day (assuming 30 days in a month).

3. Create a worksheet containing the pay details(containing Basic pay, DA, HRA ,Other Allowance , Deductions- PF,PT, Insurance, Gross and Net salary) of the employees using formulas.
4. Create a Simple Bar Chart to highlight the sales of a company for three different periods.
5. Create a Pie Chart for a sample data and give legends.

Presentation
1. Using presentation tool, Create a simple Presentation consisting of 4-5 slides about Input and Output Devices.
2. Create a presentation about a book containing Title, Author, Publisher and Contents.
3. Create an automated (with timings & animation) Presentation with five slides about different Models of Computers. Use Presentation tool.

Mini-project [CIE- 05 Marks]
1. Prepare a mini project using the above concepts of Unit-I and/or Unit-II.
   - Repair and Overhauling of PC of laboratory
   - Formatting of PC
   - Servicing of UPS
   - Prepare a report using the learned skills on Unit 1 to Unit II

Course Delivery:
The course will be delivered through tutorials of two hours and four hours of hands on practice per week

References:
1. Computer Fundamentals Concepts, Systems, Application, D.P.Nagapal, S.Chand Publication, RP-2014, ISBN: 81-219-2388-3
2. http://www.tutorialsforopenoffice.org/
3. http://www.libreoffice.org/get-help/documentation/
4. http:// www.kingsoftstore.com/

S/W Tools: Any open source tool or equivalent proprietary tools

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3,4
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3,4
				Mini Project	05	Report	1,2,3,4
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3,4 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Mini project/Student activities.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Questions for CIE and SEE will be designed to evaluate the various educational components such as:

1. Remembering and Understanding :   - 20% weightage
2. Applying the knowledge acquired from the course :   - 70 % weightage
3. Analysis :   - 1% weightage
4. Evaluation :   - 1% weightage
5. Creating new knowledge :   - 8% weightage

Scheme of Evaluation for End Exam

SN	Scheme	Max. Marks
2	Testing skills/ abilities from Unit - I	05
3	One question on Word or Power point05M), one question from spread sheet(10M) from UNIT-II	15
4	Execution of Word or Power point	10
5	Execution of spread sheet	10
6	Viva voce	10
	Total	**50**
	Note: 1. Candidate shall submit Lab Record for the Examination. 2. Student should be allowed to execute directly even if she / he unable to write the procedure 3. In case of change in experiment or no write up, marks will not be awarded for writing procedure/steps.	

Resource requirements for Basic Computer Skills Lab
(for an Intake of 60 Students [3 Batches])

Hardware requirement

Sl. No.	Equipment	Quantity
1	PC systems (latest configurations with speakers)	20
2	Laser Printers	03
3	Networking (Structured) with cat 6e / wireless 24 Port switches / Wireless Router I/O Boxes for networking(as required)	03
4	Broad Band Connection	01

Software Requirement: Linux, Libre Office / Open Office / Kingsoft Office / any equivalent software.

Note:

1. Students: Computers ratio in the Lab should be strictly 1:1 for a batch of twenty Students.

FOR PRACTICE AND FINAL EAXM

Note: *One Question from Unit-I and Unit-II*

UNIT-I

1. Identify Physical components of a Computer System.

2. Demonstrate the basic formatting features in Text Editors.

3. Create two file in a folder and place the shortcut of these files on the desktop.

4. Demonstrate how search engine may be used in browsing Internet.

5. Create an email account

6. Create and Send an email with a picture attachment.

7. Demonstrate how documents can be downloaded using Internet.
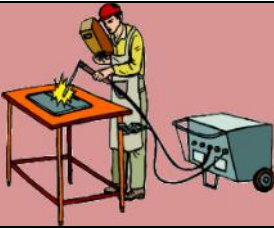
UNIT-II

1. Using Word Processor Application create a Business Letter.

2. Using Word Processor Application create a Personal Letter.

3. Using Word Processor Application create a letter head for company.

4. Using Word Processor Application create a Simple Newsletter with minimum of three columns. Insert a Clip art in the newsletter.

5. Using Word Processor Application create a Resume for a Job application.

6. Using Word Processor Application create the cover page of a Project Report (use Word Art, insert Picture Image).

7. Prepare the class time table for your class using Word Processor Application.

8. Using Spreadsheet Application, create a worksheet with five columns. Enter ten records and find the sum of all columns using auto sum feature.

9. You have a monthly income of Rs.11000. Your monthly expenditures are Rent- Rs 3500, Food- Rs. 1500, Electricity- Rs.110, Phone- Rs. 160, and Cable TV-Rs. 300. Prepare a worksheet with the Monthly Income, the Monthly Expenditures listed and summed, monthly savings amount (what's left over each month) calculated, and the amount saved per day (assuming 30 days in a month).Use Spreadsheet Application.

10. Using Spreadsheet Application, create a worksheet containing the pay details(containing Basic pay, DA, HRA ,Other Allowance , Deductions- PF,PT, Insurance, Gross and Net salary) of the employees using formulas.

11. Using Spreadsheet Application, create a Simple Bar Chart to highlight the sales of a company for three different periods.

12. Using Spreadsheet Application, create a Pie Chart for a sample data and give legends.

13. Using presentation tool, Create a simple Presentation consisting of 4-5 slides about Input and Output Devices.

14. Create a presentation about a book containing Title, Author, Publisher and Contents.

15. Create an automated (timings & animation) Presentation with five slides about different Models of Computers. Use Presentation tool.

	Course Title: **BASIC WORK SHOP PRACTICE-I**	Course Code: **15ME14P**
	Credits (L:T:P) : **0:2:4**	Core/ Elective: **Core**
	Type of course: **Demonstration & Practice**	Total Contact Hours: **78**
CIE- 25 Marks		SEE-50 Marks

Prerequisites: NIL

COURSE OBJECTIVES

1. Students able to understand different tool &equipment for work shop practice.
2. Students acquire skills for the preparation of different Carpentry/fitting/welding models.
3. Students able to understand the safety precaution in the workshop
4. Student acquires skills of Application orientated tasks.

COURSE OUTCOMES

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked practices**	**Linked PO**	**Teaching Hrs**
CO1	Ability to prepare simple wooden joints using wood working tools	*U/A*	ALL wood joint excises	1,2,3,4,5,8,9,10	**22**
CO2	Ability to Produce Fitting jobs as per specified dimensions	*U/A*	ALL fitting joint excises	1,2,3,4,5,8,9,10	**28**
CO3	Ability to prepare simple lap, butt, T-, joint and Corner joints using arc welding equipment.	*U/A*	ALL welded joint excises	1,2,3,4,5,8,9,10	**28**
				Total sessions	**78**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
BASIC WORK SHOP PRACTICE- I	3	3	3	3	3	-	-	3	3	3

COURSE CONTENTS

UNIT:I	CARPENTRY PRACTICE	CONTACT HOURS:22 Hours

Study of the joints in roofs, doors, windows and furniture available in Polytechnic

Hands-on-exercise:

1. Demonstration of different wood working machines/ Power Tools

of different wood working process, like planning, marking, Chiseling, Grooving, turning of wood etc.

2. Exercise on One simple Wood work joints like Mortise and tennon, dovetail joint by sawing, planning and cutting.

UNIT:II	FITTING SHOP	CONTACT HOURS:28 Hours

Hands-on-exercise

1. Demonstration of different fitting tools and drilling machines and power tool
2. Demonstration of different operations like chipping, filing, drilling, tapping, cutting etc.
3. Exercise on One simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc.

UNIT:III	WELDING PRACTICE	CONTACT HOURS:28 Hours

Hands-on-exercise

Study of the tools used in Arc and Gas welding practice.

1. Demonstration of different welding tools / machines.
2. Demonstration on Arc Welding, Gas Welding, gas cutting and rebuilding of broken parts with welding.
3. Exercise on One simple job involving butt, lap, Tee and corner joint.

NOTE: FOR PRACTICAL CLASSES BATCH STRENGTH IS LIMITED TO 15 TO 20.

REFERENCES

1. Ramesh Babu.V., "Engineering Practices Laboratory Manual", VRB Publishers Private Limited, Chennai, Revised Edition, 2013 – 2014.
2. Jeyachandran.K.,Natarajan.S. andBalasubramanian.S., "A Primer on Engineering PracticesLaboratory", Anuradha Publications, 2007.
3. Bawa.H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
4. RajendraPrasad.A. andSarma.P.M.M.S., "Workshop Practice", SreeSai Publication, 2002.
5. Kannaiah.P. andNarayana.K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Instructor and Foreman with an intimation to HOD
2. Each student should conduct different activity and no repeation should occur

1	Take the students for local body Carpentry works observe the carpentry practices followed in preparation of furniture/wood joints and Submit hand written report of 500 words
2	Take the students for local body Fitting works observe the fitting practices followed in preparation of fitting joints and Submit hand written report of 500 words
3	Take the students for local body welding works observe the welding practices followed in preparation of welding joints and Submit hand written report of 500 words

Course Delivery:

The course will be delivered through Demonstration and Shop practices

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment meth	CIE	IA	Students	Activities	10	Report	1,2,3
				Record- Average marks of all graded exercises to be computed.	15	Graded exercises	1,2,3
	SEE	End Exam		End of the course	50	Answer scripts at BTE	1,2,3
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2, 3Effectiveness of Delivery of instructions & Assessment Methods

Note: 1. The activity related exercises shall be evaluated as per the Rubrics developed by the concerned department related to the course.
2. The course related graded exercises to be evaluated as per performance mentioned in SEE scheme of evaluation.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	% Weightage
1	**Understanding**	**40**
2	**Applying the knowledge acquired from**	**50**
3	**Analysis**	**05**
4	**Evaluation& Creating new knowledge**	**05**

Note to IA verifier: **The following documents to be verified by CIE verifier at the end of semester**

1. Student suggested activities report for 10 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

SCHEME OF VALUATION

Note: Questions for the Semester End Exam will consist of
  i. One Welding Model. - **15 marks**
  ii. Any One Model from Fitting OR Carpentry- **30 marks**

Sl. no.	Performance	Fitting/ carpentry	Welding	Max.Marks
1	Listing of tools and operations.	05	05	10
2	Planning and marking	05	---	05
3	Performing of basic operations.	10	10	20
4	Dimensional accuracy	10	-----	10
5	Oral	-----	-----	05
	TOTAL	**30**	**15**	**50**

Tools-Fitter Section

Sl. No.	Name of equipment(Fitting shop)	Numbers Required as per norms
1.	Flat file 14″ rough bastard file	20
2.	Try square 6″	20
3.	Triangular file 10″ rough	20
4.	Half round file 10″ rough	20
5.	Hack saw frame solid 12″	20
6.	Center punch	20
7.	Ball peen hammer 11/2 Lbs	20
8.	Flat chisel 6″	20
9.	Smooth file 10″ flat	20
10.	Bench vice 8″	20
11.	Leg vice 6″	10

12.	Power hack saw	01
13.	Bench grinding	01
14.	Bench drilling machine up to 12mm cap	01
15.	Drill bit up to 12mm straight shunk	04
16.	Tap set and die set up to 1″	01
17.	Vernier caliper	10
18.	Spring divider	20
19.	Steel scale	20
20.	Vernier height gauge	01
21.	Surface plate 2x3 feet	02
22.	Number punch	01
23.	Anvil	20
24.	V block	02

Carpentry Tools required for –

Sl. No	Name of equipment(Carpentry shop)	Numbers Required as per Norms
1.	Carpenter bench vice	20
2.	G or C clamp 6″	20
3.	Marking gauge	20
4.	Try square 19mmx4″	20
5.	Wooden mallet	20
6.	Firmer chisel 2″	20
7.	Firmer chisel 3/4″	20

Sl. No.		Numbers
8.	Mortise chisel 1/2″	20
9.	Metal jack plane 9″	20
10.	Beveled square 6″	20
11.	Hand saw or cross cut saw	20
12.	Steel scale 12″	20

Tools- welding

Sl. No.	Name of equipment(Welding shop)	Numbers Required as per norms
1.	Arc welding transformer up to 300Amps	03
2.	Welding shield	20
3.	Ball peen Hammer 11/2 Lbs	10
4.	Chipping Hammer	10
5.	Wire brush	10
6.	Anvil	01
7.	Hand Gloves	05
8.	Flat tongs	10
9.	Steel scale	10
10.	Flat file 14″ rough bastard file	10
11.	Oxygen cylinder	01
12.	Acetylene cylinder	01
13.	Gas welding torch	05
14.	Spark lighter	05
15.	Gas welding goggles	10
16.	Gas cutting torch	02

17.	Try square 6"	10

MODEL QUESTIONS FOR PRACTICE AND SEE

DEPARTMENT OF MECHANIACL ENGG.

COURSE TITTLE:**BASIC WORKSHOP PRACTICE-1**

TIME: 3 HOURS   MARKS:50

One Welding Model is compulsory and any one   Model from Fitting OR carpentry

(Out of two models 30 marks for Fitting OR carpentry and 15 marks for welding)

FOR CARPENTRY SHOP

1.

Figure   shows drawing of a bridle joint. Copy the figure and make the
joint using the given wooden piece.
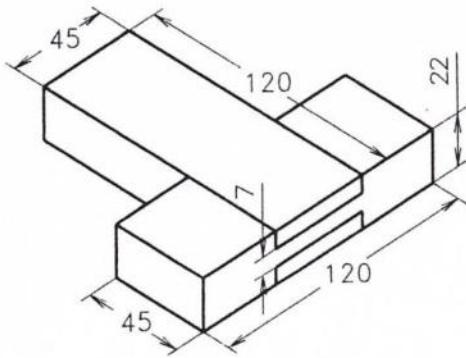
2.

Make the following models, the allotted time is 3 hours:

Figure   shows drawing of a dove-tail (halved) joint. Copy the figure and
make the joint using the given wooden piece.
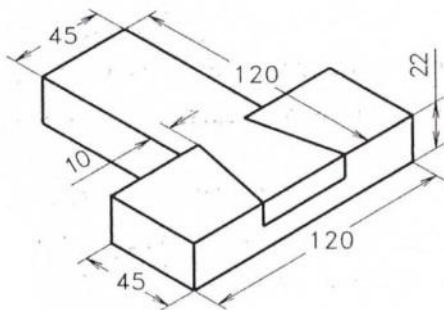
3.

Copy the sketch of the cross (halved) joint given in Figure ` and then make the joint using the given wooden piece.
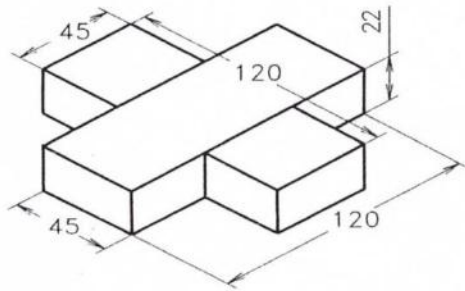
4.

Make a mortise and tenon joint of size shown in Figure using the given wooden piece. Also prepare a dimensioned neat sketch of the joint.
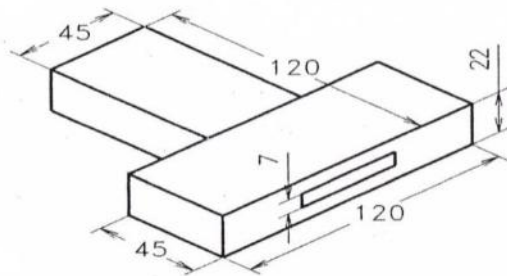
5.

Example

Make a Tee (halved) joint of the dimensions given in Figure using the given wood piece. The time allotted is 3 hours.
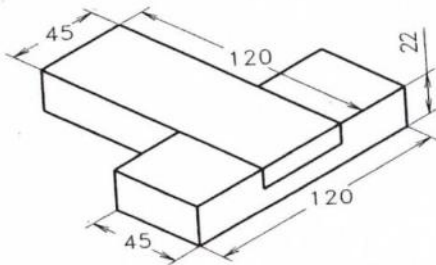
FOR FITTING SHOP

1.

Example

Make a square joint of the dimensions given in Figure   using the given MS flat. The time alloted is 3 hours.
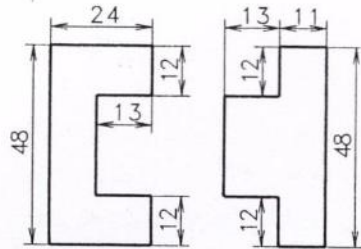
2.
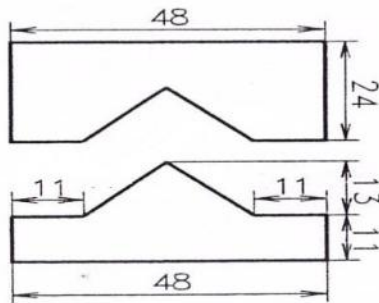
3.
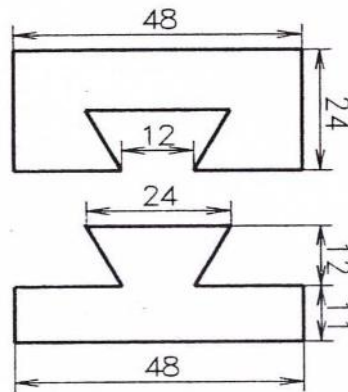
4.

Figure   gives drawing of a trapezoidal joint. Copy the figure and make the model using the given MS flat piece.
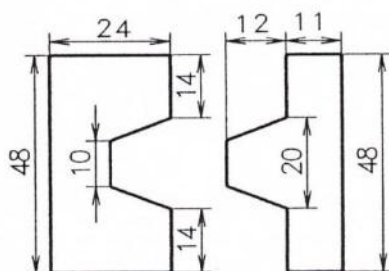
5.

Copy the sketch of the stepped joint given in Figure   Then make the joint using the given MS flat piece.
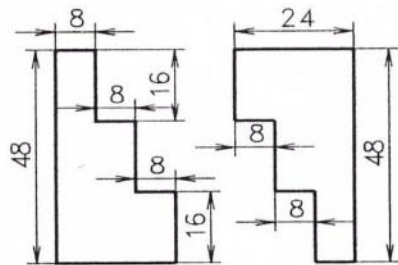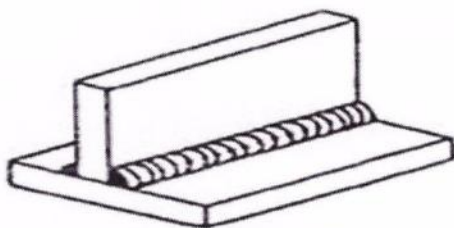

FOR WELDING SHOP

Copy the given sketch of the joint ,then make the joint using the given MS flat piece.
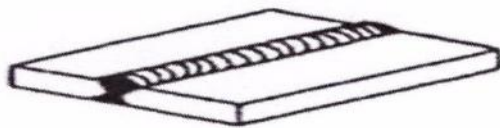
A. BUTT JOINT
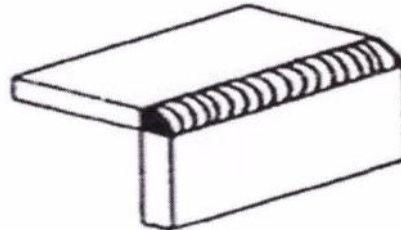
B. CORNER JOINT

C. TEE JOINT

D. LAP JOINT

MODEL QUESTIONS FOR VIVA VOCE

CARPENTRY SHOP

1. Differentiate between soft wood and hard wood.
2. Give the list of the common names of timber suitable for carpentry work.
3. Describe the term plywood. How it is obtained as large size sheets.
4. What are the marking tools used in wood working.
5. What is meant by marking gauge? How it is used for marking.
6. Give a list of the saws used for cutting wood.
7. What is cross cut saw and tenon saw.
8. What are the types of chisels used for wood working?
9. What is meant by mallet? What is the use of mallet?
10. Give the list of the plaining tools used in carpentry shops.
11. Describe briefly the construction of use of a wooden jack plane.
12. Name the types of work holding devices used for carpentry work.
13. Explain the use of bench vice.
14. Describe the working principle of band saw and circular saw.
15. What are the common defects in timber?
16. Mention the important carpentry tools.
17. What are the marking and measuring tools used in carpentry?
18. Mention the different types of saws and explain.
19. What is spokes have?
20. What is boring tools? And its uses.
21. What are the striking tools and its uses?
22. What are the holding tools and its uses?
23. What is uses of the Rasps and Pincer
24. What are the carpentry processes used in wooden construction.
25. Mention the types carpentry joints

FITTING SHOP
1. Give a list of types of tools used in fitting operations.
2. Explain the types of work holding devices used in fitting.
3. Describe briefly the types of files used in fitting.
4. Explain the construction of a hack saw.
5. What are the types of cold chisels and for what purposes they are used.
6. Describe briefly the types of hammers used.
7. Define the term twist drill; distinguish a drill from a reamer.
8. What is a surface plate? For what purpose it is used.
9. What are the types of tools used for marking?
10. Explain the use of steel rule and a vernier caliper.
11. Explain the use of the different types of inside and outside calipers.
12. What is the use of combination set?
13. Describe how a micrometer is used for measuring a size.
14. Mention the commonly used in bench and fitting work.
15. Name the parts of a hand hammer.
16. What are the classifications of hammers?
17. What is the use of the flat, cross-cut, half round, diamond point, side chisels.
18. What is chipping?
19. Name the different parts of a file.

20. What is single cut and double cut of a file.
21. Mention the most commonly used shapes in files.
22. What is filing and mention the method of filing.
23. What is cross filing, straight filing and draw filing
24. What is a scraper and mention types of scraper.
25. What is the use of hacksaw and mention its types.
26. Mention the tools used for making.
27. What are the uses of Surface plate, Scriber, Punch, V-block, Angle plate, andtrysquare?

WELDING SHOP
1. What is welding
2. How u classify welding.
3. What is arc welding
4. What is an arc
5. What is the equipment used for arc welding.
6. How you set the voltage in arc welding
7. What is normal temperature for arc welding?
8. What are latest techniques used in arc welding.
9. What is an edge preparation?
10. Which type of electrode used in arc welding?
11. What is gas welding?
12. Name the different gases used in gas welding.
13. What are the applications of gas welding?
14. What is the equipment used in gas welding.
15. What is a flame?
16. Name the different types of flames.
17. What are the differences between Arc & Gas welding?
18. Which type of welding is used for sheet metals?
19. What are the defects in welding?
20. What are the precautions to be taken for welding?
21. Name the different safety devices used in welding
22. Name the different joints in welding.
23. What is a torch? Which welding used the torch?
24. What is Nozzle?
25. What is filler material in welding?
26. What are differences between welding & soldering?

Course Title: **ENGINEERING MATHEMATICS – II**		Course Code	: **15SC02M**
Semester	: **II**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **4:0:0**(in hours)	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**
Programmes: **Common to all Engineering Diploma Programmes**			

Pre-requisites:

Engineering Mathematics-I, in First Semester Diploma curriculum.

Course Objectives:

1. Apply the concept of straight line and conic section in engineering field.
2. Determine derivatives of functions involving two variables.
3. Apply the concepts of differentiation in physics and engineering courses.
4. Evaluate the integrals of functions of two variables.
5. Apply the concepts of definite integrals and its application over a region.
6. Solve the ODE of first degree, first order in engineering field.

Course Contents:

Topic and Contents	Hours	Marks
Unit-1: COORDINATE GEOMETRY	08hr	23
a. **Straight lines:** Different forms of equations of straight lines: $y = mx + c,$ $y - y_1 = m(x - x_1),$ $y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1).$ General equation of a line $ax + by + c = o$ (graphical representation and statements) and problems on above equations. Equation of lines through a point and parallel or perpendicular to a given line. Problems.	04 hr	
b. **Conic Section:** Definition of conic section. Definition of axis, vertex, eccentricity, focus and length of latus rectum. Geometrical representation of parabola, ellipse and hyperbola: Equations of parabola $y^2 = 4ax,$	04hr	

Equation of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and Equation of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (without proof of above 3 equations). Equations of parabola, ellipse and hyperbola with respect to x-axis as axis of conic. Finding axes, vertices, eccentricity, foci and length of lattice rectum of conics. Problems on finding the above said equations with direct substitution.		
UNIT – 2: DIFFERENTIAL CALCULUS	15hr	39
Differentiation. Definition of increment and increment ratio. Definition of derivative of a function. Derivatives of functions of x^n, $\sin x$, $\cos x$ and $\tan x$ with respect to 'x' from first principle method. List of standard derivatives of $\operatorname{cosec} x, \sec x, \cot x, \log_e x, a^x, e^x$ ......etc. Rules of differentiation: Sum, product, quotient rule and problems on rules. Derivatives of function of a function (Chain rule) and problems. Inverse trigonometric functions and their derivatives. Derivative of Hyperbolic functions, Implicit functions, Parametric functions and problems. Logarithmic differentiation of functions of the type u^v, where u and v are functions of x. Problems. Successive differentiation up to second order and problems on all the above types of functions.		
UNIT – 3: APPLICATIONS OF DIFFERENTIATION.	07hr	17
Geometrical meaning of derivative. Derivative as slope. Equations of tangent and normal to the curve y = f(x) at a given point- (statement only). Derivative as a rate measure i.e.to find the rate of change of displacement, velocity, radius, area, volume using differentiation. Definition of increasing and decreasing function. Maxima and minima of a function.		
UNIT-4: INTEGRAL CALCULUS.	12hr	30
Definition of Integration. List of standard integrals. Rules of integration (only statement) $1. \int kf(x)dx = k \int f(x)dx.$ $2. \int \{f(x) \pm g(x)\}dx = \int f(x)dx \pm \int g(x)dx$ problems. Integration by substitution method. Problems. **Standard integrals of the type**		

$$1. \int \frac{dx}{x^2 + a^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + c \qquad 2. \int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + c.$$

$$3. \int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right) + c$$

(1 to 3 with proof)

$$4. \int \frac{dx}{x^2 - a^2} = \frac{1}{2a}\log\left(\frac{x-a}{x+a}\right) + c \quad \text{if } x > a > 0.$$

$$5. \int \frac{dx}{a^2 - x^2} = \frac{1}{2a}\log\left(\frac{a+x}{a-x}\right) + c \quad \text{if } a > x > 0. \qquad (4 \& 5 \text{ without proof})$$

and problems on above results Integration by parts of the type $\int x^n e^x dx$,$\int x\sin x dx$, $\int x\cos x dx$, $\int x\log x dx$, $\int \log x dx$, $\int \tan^{-1} x\, dx$, $\int x\sin^2 x\, dx$, $\int x\cos^2 x\, dx$ where n=1, 2. Rule of integration by parts. Problems

UNIT – 5: DEFINITE INTEGRALS AND ITS APPLICATIONS	05 hr	22
Definition of Definite integral. Problems on all types of integration methods. Area, volume, centres of gravity and moment of inertia by integration method. Simple problems.		
UNIT – 6: DIFFERENTIAL EQUATIONS.	05 hr	14
Definition, example, order and degree of differential equation with examples. Formation of differential equation by eliminating arbitrary constants up to second order. Solution of O. D. E of first degree and first order by variable separable method. Linear differential equations and its solution using integrating factor.		
Total	52	145

Course Delivery:

The Course will be delivered through lectures, class room interaction, exercises, assignments and self-study cases.

Course outcome:

On successful completion of the course, the student will be able to:
1. Formulate the equation of straight lines and conic sections in different forms.
2. Determine the derivatives of different types of functions.
3. Evaluate the successive derivative of functions and its application in tangent, normal, rate measure, maxima and minima.
4. Evaluate the integrations of algebraic, trigonometric and exponential function.
5. Calculate the area under the curve, volume by revolution, centre of gravity and radius of gyration using definite integration.
6. Form and solve ordinary differential equations by variable separable method and linear differential equations.

Mapping Course Outcomes with Program Outcomes:

CO	Course Outcome	PO Mapped	Cognitive Level	Theory Sessions	Allotted marks on cognitive levels			TOTAL
					R	U	A	
CO1	Formulate the equation of straight lines and conic sections in different forms.	1,2,3,10	R/U/A	08	6	5	12	23
CO2	Determine the derivatives of different types of functions.	1,2,3,10	R/U/A	15	12	15	12	39
CO3	Evaluate the successive derivative of functions and its application in tangent, normal, rate measure, maxima and minima.	1,2,3,10	R/U/A	07	6	5	6	17
CO4	Evaluate the integrations of algebraic, trigonometric and exponential function	1,2,3,10	R/U/A	12	9	15	6	30
CO5	Calculate the area under the curve, volume by revolution, centre of gravity and radius of gyration using definite integration	1,2,3,10	R/U/A	05	6	10	6	22
CO6	Form and solve ordinary differential equations by variable separable method and linear differential equations.	1,2,3,10	R/U/A	05	3	5	6	14
		Total Hours of instruction		52	**Total marks**			145

R-Remember; U-Understanding; A-Application

Course outcomes –Program outcomes mapping strength

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Engineering Maths-II	3	3	3	-	-	-	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Reference Books:

1. NCERT Mathematics Text books of class XI and XII.
2. Higher Engineering Mathematics by B.S Grewal, Khanna publishers, New Delhi.
3. Karnataka State PUC mathematics Text Books of I & II PUC by H.K. Dass and Dr. Ramaverma published by S.Chand & Co.Pvt. ltd.
4. CBSE Class Xi & XII by Khattar & Khattar published PHI Learning Pvt. ltd.,
5. First and Second PUC mathematics Text Books of different authors.
6. E-books:www.mathebook.net
7. www.freebookcentre.net/mathematics/ introductory-mathematics -books.html

Course Assessment and Evaluation:

Method	What		To whom	When/where (Frequency in the course)	Max Marks	Evidence collected	Contributing to course outcomes
DIRECT ASSMENT	*CIE	Internal Assessment Tests	Student	Three tests (Average of Three tests to be computed).	20	Blue books	1 to 6
		Assignments		Two Assignments based on CO's (Average marks of Two Assignments shall be rounded off to the next higher digit.)	5	Log of record	1 to 6
				Total	25		
	*SEE	Semester End Examination		End of the course	100	Answer scripts at BTE	1 to 6
INDIRECT ASSESSMENT	Student feedback		Student	Middle of the course	-NA-	Feedback forms	1 to 3, delivery of the course
	End of Course survey			End of course		Questionnaire	1 to 6, Effectiveness of delivery of instructions and assessment methods

*CIE – Continuous Internal Evaluation ***SEE** – Semester End Examination
Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	31
2	Understanding	41
3	Applying the knowledge acquired from the course	25
	Analysis Evaluation	3

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**ENGINEERING MATHEMATICS –II**	20
	Year:	Course code: **15SC02M**	

Name of Course coordinator :   Units:__ CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Model Question Paper:

II Semester Diploma Examination
ENGINEERING MATHEMATICS –II
(For All Engineering Diploma Programmes)

Time: 3 Hours][Max. Marks: 100

NOTE: i)Answer any 10 questions from section A, 8 questions from section B and 5 questions from
      section-C

ii) Each question carries 3 marks in section A.

 ii) Each question carries 5 marks in section B.

    iii) Each question carries 6 marks in section C.

SECTION-A

1. Find the equation of the line passing through the point (2,-3) with slope 1/3.
2. Find the equation of parabola with vertex (2,0) and focus (5,0)
3. Differentiate: $(3x + 8)^7$ with respect to x.
4. If $y = \cos^{-1} x$ show that $\frac{dy}{dx} = \frac{-1}{\sqrt{1-x^2}}$.
5. If $y = x^x$, find $\frac{dy}{dx}$.
6. If $y = \frac{1+\sin x}{1-\sin x}$ find $\frac{dy}{dx}$.
7. Find the equation to the tangent to the curve $2x^3 + 5y - 4 = 0$ at (-2,4).
8. The volume of the sphere is increasing at the rate of 6cc/sec. Find the rate of
   change of radius when the radius is 3 cm.
9. Integrate: $(2x + 1)(x + 5)$ with respect to x
10. Evaluate: $\int \tan^2 x\, dx$
11. Evaluate: $\int \frac{\cos x}{1+\sin x} dx$
12. Evaluate: $\int_0^{\pi/4}(\sec^2 x + 1)dx$.
13. Find area bounded by the line $x + 2y = 0$, x- axis, and ordinates $x = 0$, and$x = 4$ by
    integration.
14. Form differential equation for curve $y^2 = 4ax$

SECTION – B

1. Find the equation of line passing through the point (2,5) and (-3,2).
2. Differentiate $\sqrt{x} + \log x + \sin^{-1} x + e^{\tan x} - a^x$ with respect to x.
3. Differentiate $\tan x$ with respect to x using first principal method.
4. If $y = \sinh 3x \cosh 2x$ then find $\frac{dy}{dx}$.
5. If $S = t^3 - t^2 + 9t + 8$, where S is distance travelled by particle in t seconds. Find the
   velocity and acceleration at t = 2 sec.
6. Integrate: $\frac{1}{x} - \tan x + e^{-3x} + \frac{1}{1+x^2} + 5$ with respect to x.
7. Evaluate: $\int \frac{(1+\log x)^2}{x} dx$
8. Evaluate: $\int x \sin x\, dx$

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9. Evaluate: $\int_0^{\pi/2} \cos 5x \cos 3x \, dx$

10. Evaluate: $\int_0^{\pi/2} \cos^3 x \, dx$

11. Solve the differential equation $\sin^2 y \, dx - \cos^2 x \, dy = 0$

SECTION – C

1. Find the equation of median through B in a triangle with vertices A(-1 ,3), B(-3, 5) and C(7,-9)

2. Find the equation of hyperbola, given that vertices are $(\pm 7, 0)$ and eccentricity, e=4/3

3. If $x^y = a^x$, show that $\frac{dy}{dx} = \frac{x \log_e a - y}{x \log_e x}$.

4. If $y = e^{\tan^{-1} x}$ then show that $(1 + x^2) \frac{d^2 y}{dx^2} + (2x - 1) \frac{dy}{dx} = 0$.

5. Find the maximum and minimum values of the function
$f(x) = 2x^3 - 21x^2 + 36x - 20$.

6. Evaluate: $\int \tan^{-1} x \, dx$

7. Find the volume of solid generated by revolving the curve
$y = \sqrt{x^2 + 5x}$ between x=1 & x=2.

8. Solve the differential equation $x \frac{dy}{dx} - 2y = 2x$

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Question Paper Blue Print:

Course: **ENGINEERING MATHEMATICS – II** Course Code**: 15SC02M**

UNIT NO		HOURS	Each questions to be set for 3 Marks Section - A	Each questions to be set for 5 Marks Section - B	Each questions to be set for 6 Marks Section- C	Weightage of Marks
1	a	4	01	01	01	23
	b	4	01	--	01	
2		15	04	03	02	39
3		07	02	01	01	17
4		12	03	03	01	30
5		05	02	02	01	22
6		05	01	01	01	14
TOTAL		52	14	11	08	145
Questions to be answered			**10**	**08**	**05**	**100**

Guidelines to Question Paper Setting:

1. The question paper must be prepared based on the blue print without changing the weight age of model fixed for each unit.
2. The question paper pattern provided should be adhered to
   Section-A: 10 questions to be answered out of 14 questions each carrying 03 marks.
   Section-B: 08 questions to be answered out of 11 questions each carrying 05 marks.
   Section-C: 05 questions to be answered out of 08 questions each carrying 06 marks.
3. Questions should not be set from the recapitulation topics.

Model Question Bank:

| Course Title: **ENGINEERING MATHEMATICS – II** | Course Code: **15SC02M** |

UNIT-1: STRAIGHT LINES AND CONIC SECTION:

3 MARK QUESTIONS

1. Find the equation of the straight line passing through (2,3) and having slope 5.
2. Find the slope and x-intercept and y-intercepts of the line $2x + 3y - 11 = 0$.
3. Find the vertex and focus of the parabola $(y - 2)^2 = 8x$.
4. Show that the lines 3x-2y+2=0, 2x+3y+7=0 are perpendicular.
5. Find the eccentricity of the ellipse $\frac{x^2}{64} + \frac{y^2}{9} = 1$

5 MARK QUESTIONS

1. Find the equation to the line passing through the point (6,-4) and perpendicular to the line 7x-6y+3=0.
2. Find the equation to the line passing through the point (2,3) parallel to the line joining the points (-8,-6) & (2,-4).
3. Find the equation of straight line inclined at 135o to the x-axis having y-intercept 2/3.
4. Find the equation of straight line joining the points (2,3) & (-4,6).
5. Find the equation of the line passes through (-3,-2) which is perpendicular to x-axis.

6 MARK QUESTIONS

1. Find the equation to the median of the triangle through the vertex A with vertices A(-1,3), B(-3,5) &C(7,-9).
2. The vertices of a quadrilateral taken in order are A(1,2), B(2,1),C(3,4) & D(-1,-2). Find the equation to the diagonal BD.

3. Obtain the equation of the hyperbola in the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,$ whose eccentricity is 8 and distance between the foci is 12.
4. Find the equation of the ellipse with length of major axis is 8 and minor axis is 3.
5. Find the equation to the line passing through point (3,-2) and perpendicular to the line joining points (5,2) &(7,-6).

UNIT-2: DIFFERENTIATION:

3 MARK QUESTIONS

1. Find $\frac{dy}{dx}$, if $y = 2x^2 - 3x + 1$.

2. Differentiate $x \tan x$ with respect to x.

3. Find $\frac{dy}{dx}$, if $x^2 + y^2 = 25$

4. Find $\frac{dy}{dx}$ if $x = ct, y = \frac{c}{t}$,

5. If $y = 4ax$, find $\frac{d^2y}{dx^2}$.

5 MARK QUESTIONS:

1. Differentiate the function x^n by method of first principle.
2. Find $\frac{dy}{dx}$ if $y = 6x^3 - 3\cos x + 4\cot x + 2e^{-x} - \frac{5}{x}$.
3. Find $\frac{dy}{dx}$ if $y = \frac{\cos x + \sin x}{\cos x - \sin x}$
4. Find $\frac{dy}{dx}$ if $y = (\cos x)^{\sin x}$
5. If $y = \tan^{-1} x$, prove that $(1 + x^2)y_2 + 2xy_1 = 0$

6 MARK QUESTIONS:

1. Find $\frac{dy}{dx}$ if $y = \frac{x \log x}{1 + \sin x}$
2. Find $\frac{dy}{dx}$ if $x = a \cos^3 \theta, y = a \sin^3 \theta$ at $\theta = \pi/4$.

3. Find $\frac{dy}{dx}$ if $y = x^{x^{x^{x^{\cdot^{\cdot^{\infty}}}}}}$.

4. If $y = \tan^{-1}\left(\frac{1+x}{1-x}\right)$, find $\frac{dy}{dx}$.

5. If $y = e^{m \sin^{-1} x}$, prove that $(1 - x^2)y_2 - xy_1 - m^2y = 0$

UNIT-3 APPLICATIONS OF DIFFERENTIATION

3 MARK QUESTIONS

1. Find the slope of the tangent to the curve $x^2 + 2y^2 = 9$ at a point (1, 2) on it.
2. Find the slope of the normal to the curve $y = 2 - 3x + x^2$ at (1, 0).
3. The law of motion of a moving particle is $S = 5t^2 + 6t + 3$ where 'S' is the distance in metres and 't' time in seconds. Find the velocity when t=2.
4. Find the rate of change of area of a circle with respect to its radius.
5. Show that the curve $2x^3 - y = 0$ is increasing at the point (1, 2).

5 MARK QUESTIONS

1. For a moving body vertically upwards, the equation of motion is given by $S = 98t - 4.9t^2$. When does the velocity vanish?
2. Find the equation to the tangent to the curve $y = 2x^2 - 3x - 1$ at (1,-2).
3. A circular patch of oil spreads on water and increases its area at the rate of 2 sq.cm/min. find the rate of change of radius when radius when radius is 4 cm.
4. The volume of the spherical ball is increasing at the rate of 36π cc/sec. Find the rate at which the radius is increasing. When the radius of the ball is 2cm.
5. Find the max value of the function $y = x^3 - 3x + 4$.

6 MARK QUESTIONS

1. Find the max & min values of the function $y = x^5 - 5x^4 + 5x^3 - 1$.
2. Find the equation of normal to the curve $y = x^2 + 2x + 1$ at (1,1).
3. If S is the equation of motion where $S = t^3 - 2t^2$ find its acceleration when velocity is 0.
4. The volume of sphere is increasing at 3c.c per second. Find the rate of increase of the radius, when the radius is 2cm.
5. Water is flowing into a right circular cylindrical tank of radius 50 cms at the rate of 500π cc/min. Find how fast is the level of water going up.

UNIT-4: INTEGRATION

3 MARK QUESTIONS

1. Evaluate: $\int (x^2 + x + 1)\, dx$.
2. Evaluate: $\int \cot^2 x\, dx$
3. Evaluate: $\int e^{5x+8}\, dx$
4. Evaluate: $\int \frac{1}{2x+5}\, dx$
5. Evaluate: $\int \sin^5 x \cos x\, dx$

5 MARK QUESTIONS

1. Evaluate $\int \left(x^4 - \frac{1}{x} + \operatorname{cosec}^2 x - e^{-2x} + \cos x\right) dx$.
2. Evaluate: $\int \cos^3 x \, dx$
3. Evaluate: $\int \sin 6x \cos 2x \, dx$
4. Evaluate: $\int \log x \, dx$
5. Evaluate: $\int \frac{(\tan^{-1} x)^3}{1+x^2} dx$

6 MARK QUESTIONS

1. Evaluate: $\int (\tan x + \cot x)^2 dx$.
2. Evaluate: $\int (x+1)(x-2)(x-3) dx$
3. Evaluate: $\int x^2 \cos x \, dx$
4. Prove that $\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c$
5. Evaluate: $\int \frac{1}{9\sin^2 x + 4\cos^2 x} dx$

UNIT-5: DEFINITE INTEGRATION AND ITS APPLICAITON.

3 MARK QUESTIONS

1. Evaluate: $\int_2^3 (2x + 1) \, dx$.
2. Evaluate: $\int_0^{\pi/4} \sec^2 x \, dx$.
3. Evaluate: $\int_0^2 e^x \, dx$
4. Evaluate: $\int_0^1 \frac{(\sin^{-1} x)^2}{\sqrt{1-x^2}} dx$.
5. Evaluate: $\int_0^{\pi/2} \cos x \, dx$.

5 MARK QUESTIONS

1. Evaluate: $\int_0^{\pi/2} \sin 3x \cos x \, dx$.
2. Evaluate: $\int_0^\pi \frac{\cos x}{1+\sin^2 x} dx$.
3. Evaluate: $\int_0^1 x(x-1)(x-2) \, dx$.
4. Find the area bounded by the curve $y = x^2 + 1$ the x-axis and ordinates $x = 1, x = 3$.
5. Find the volume of the solid generated by the revolving of the curve $y^2 = x^2 + 5x$ between the ordinates x=1, x=2 about x-axis.

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6 MARK QUESTIONS

1. Evaluate: $\int_0^1 \frac{\cos(\tan^{-1} x)}{1+x^2} dx$.
2. Find the area between the curves $y = x^2 + 5$ and $y = 2x^2 + 1$.
3. Find the volume of ellipsoid generated by revolving $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ between the ordinates $x = \pm a$ about x-axis.
4. Find the centre of gravity of a solid hemisphere.
5. Determine the moment of inertia of a uniform rod of length 2l, Cross-sectional area "a" about an axis perpendicular to the rod and passing through the mid-point of the rod.

UNIT-6: INTEGRATION

3 MARK QUESTIONS

1. Write the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^8 + 3\frac{d^2y}{dx^2} - ye^x = 0$.
2. Form the differential equation by eliminating arbitrary constants in $y = m\,e^{2x}$.
3. Solve $xdx + ydy = 0$.
4. Solve $\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$.
5. Solve $e^x dx + dy = 0$.

5 MARK QUESTIONS

1. Form the differential equation by eliminating arbitrary constants A and B in $y = Ae^x + Be^{-x}$.
2. Form the differential equation by eliminating arbitrary constants in $y = a\cos mx + b\sin mx$.
3. Solve $(1 + y)dx + (1 + x)dy = 0$.
4. Solve $\frac{dy}{dx} + 3y = e^{2x}$.
5. Solve $\frac{dy}{dx} + y\tan x = \cos x$

6 MARK QUESTIONS

1. Solve $x(1 + y^2)dx + y(1 + x^2)dy = 0$.
2. Solve $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$.
3. Solve $x\frac{dy}{dx} + y = x^3$
4. Solve $\frac{dy}{dx} + 3y = e^{2x}$.
5. Solve $\frac{dy}{dx} + 2y\cot x + \sin 2x = 0$

Government of Karnataka
Department of Technical Education, Bengaluru

Course: ENGINEERING MATHEMATICS - II
Course code: 15SC02M

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1	Dr. D.S. Prakash	Asst. Director (LRDC)	DTE, Bengaluru
2	Dr.MokaShekhu	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
3	Sri.Sathyanaraya Dixit	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru
4	Sri. Guruprasad V	Lecturer (Selection Grade /Science)	APS Polytechnic, Somanahalli
5	Dr.RajasekharHeera	Lecturer/Science,	Government Polytechnic, Gulbarga.

Curriculum Review committee

	Name	Designation	Institution
1	Dr.MokaShekhu	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
2	Sri.Sathyanaraya Dixit	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title	:**APPLIED SCIENCE**	Course Code	: **15SC03S**
Semester	: **I / II**	Course Group	: **Core**
Teaching Scheme in Hrs (L:T:P)	: **4:0:0**	Credits	: **4 Credits**
Type of course	: **Lecture &Assignments**	Total Contact Hours	: **52**
CIE	: **25 Marks**	SEE	: **100 Marks**
Programme: **Common to all Engineering Diploma Programmes**			

Prerequisite:

Dynamics, Heat, Sound, Matter, recent trends in Physics, Basic chemistry in Secondary Education.

Course Objective:

1. Learn concepts of Units, Laws of vectors, parallel forces, moment of force, couple.
2. Learn the fundamentals of properties and behavior of the materials
3. Learn the concepts of heat and thermodynamics.
4. Enhance theoretical and practical principles with applications of sound wave.
5. Understand different types of communication systems.
6. Develop awareness about corrosion, materials, and energy sources in engineering field.

Course Content:

UNIT I:MECHANICS (08 Hrs)

Units and Measurements: Definition of unit, types of unit (fundamental and derived)
SI units: Definition, Basic and supplementary units, advantages.
Measuring Instruments: Vernier calipers, principle and least count, diagram of vernier calipers with labeling the parts. Screw gauge(pitch, ZE, ZC), principle and least count, diagram of screw gauge with labeling the parts, simple problems.

Scalars and Vectors: Definition of scalar and vector with examples, representation of a vector, definition of resultant, equilibrium and equilibrant. Laws of vectors: Statement of law of parallelogram of forces, Converse law of triangle of forces, Lami's theorem. Deriving an expression for magnitude and direction of resultant of two vectors acting at a point. Resolution of vectors, mentioning rectangular component of resolution of vector.

Experimental verification of law of parallelogram of forces, Converse law of triangle of forces, Lami's theorem. Simple problems on laws of vectors

Parallel forces. Types of parallel forces, Moment of force: definition, S.I unit, types and examples. Couple: definition with examples. Moment of a couple. Conditions of equilibrium of coplanar parallel forces, applications. Experimental verification of Conditions of equilibrium of coplanar parallel forces using moment bar and simple problems.

UNIT-2: PROPERTIES OF SOLIDS AND LIQUIDS: (10 Hrs)

Properties of solids: Definitions of deforming force, elasticity and plasticity, examples for elasticity and plasticity, definition of stress and its types with examples and its S.I unit, definition of strain and its types with examples, elastic limit, Hooke's law, stress - strain graph with explanation. Modulie of elasticity and its types, derivation of an expression for Young's modulus of a material. Definition of Compressibility and factor of safety. Simple problems on stress, strain and Young's modulus.

Properties of liquids: Definition of thrust and pressure with S.I units. Derivation of expression for pressure at a point inside the liquid at rest, simple problems.

Energy of liquid in motion: Kinetic, Potential energies and Pressure energy in moving liquid. Bernoulli's theorem: statement and expression (No derivation). Cohesive and adhesive forces, angle of contact.

Surface Tension: Definition of surface tension and its S.I unit, factors affecting surface tension, applications of surface tension, capillarity and its applications.

Viscosity: Types of flow of liquid, definition of stream line flow and turbulent flow, definition of viscosity, expression for coefficient of viscosity, experimental determination of coefficient of viscosity of water, effect of temperature on viscosity. List of applications of viscosity. Simple problems.

UNIT III: HEAT AND PROPERTIES OF GASES.   (07Hrs)

Concept of heat & temperature: Definitions of heat and temperature with S.I units, definition of Specific heat of substance with S I unit, equation for specific heat of a substance (no derivation).

Transmission of heat: Definitions of conduction, convection and radiation with examples, definition of thermal conductivity, derivation of co-efficient of thermal conductivity(K) and its S.I unit. Applications of conduction, convection and radiation, simple problems on K.

Gas laws: Statement of Boyle's law, Charle's law, Gay-Lussac's law, derive the relation between them (PV=nRT), definition of C_p and C_v ,relation between them (Mayer's equation no derivation), simple problems on Boyle's law and Charle's law.

Thermodynamics: Definition of thermodynamics, Laws of thermo dynamics: Zeroth law, Istlaw and IIndlaw (only statement), types of thermodynamics process: isothermal process, adiabatic process.

UNIT IV: WAVE MOTION   (10Hrs)

Simple Harmonic Motion: Definition of periodic motion with example, definition of Simple Harmonic Motion, representation of S.H.M with respect to particle in circular motion, derivation of displacement of a particle executing S.H.M. Definitions of period, frequency, amplitude, in case of vibrating particle.
Wave: Definition of wave, wave period(T), wave frequency (n or f), wave amplitude (a), wave length(λ) and wave velocity (v) in case of wave motion. Derive the relation between v, n and λ. simple problems.
Types of waves: Mechanical and Non mechanical waves with examples. Definition of longitudinal and transverse waves, differences.
Propagation of sound waves in air: Newton's formula for the velocity of sound in air and Laplace's correction to it, various factors affecting velocity of sound in air. Simple problems.
Vibrations: Free vibrations, Forced vibration, Damped vibrations and Un-damped vibrations with examples. Resonance with examples. Laws of transverse vibrations of stretched string, derivation of equation for fundamental frequency of vibrations of stretched string. Simple problems.
Experiment to determine the unknown frequency of a given tuning fork by absolute and comparison methods using sonometer.
Stationary waves: Formation of stationary waves and their characteristics. Experimental determination of velocity of sound in air by using resonance air column apparatus.
Beats: Formation of Beats, definition of beat frequency, its applications.

UNIT V:MODERN PHYSICS   (07Hrs)

Electromagnetic waves: Definition, generation of electromagnetic waves and their properties.

Electromagnetic spectrum: Definition, classification and its applications.

Lasers: Principle and listing the types of Laser, properties of Laser, applications.
Nano-Technology: Definition of Nano-Technology, advantages and dis-advantages of nano-Technology.

Advance Communication Systems: Basic elements of communication systems with block diagram, List commonly used terms in electronic communication systems.

Satellite communication: Introduction, advantages and disadvantages,
Optical fiber: principle and applications.

UNIT VI: INDUSTRIAL CHEMISTRY   (10 Hrs)

Electrolysis: Definition of electrolyte, types of electrolytes with examples, definition of electrolysis. Arrhenius theory of electrolytic dissociation. Mechanism of Electrolysis. Faradays laws of Electrolysis: state and explain.
Corrosion: Definition, necessary conditions for corrosion, electrochemical theory of corrosion, list the preventive methods of corrosion.
Batteries: Basic concept, classification and applications of batteries.
Fuel cells: Definition, mentioning the types and advantages.
Metallurgy: Definitions of minerals, ore, flux, slag, alloys. Purpose of making alloys, composition and uses of alloys.
Polymers: Definition and classification of polymers, methods of polymerization and applications.
Composite materials: Definition, types, advantages and dis-advantages of composite materials.
Solutions: Definition of solute, solvent, solutions. Saturated and unsaturated solutions, concentration of solutions: normal, molar and molal solutions, simple problems on concentration of solution.
pH Value: Hydrogen ion concentration and concept of pH, definition of pH of solution, pH scale, applications of pH in different fields.

Course Delivery:

The Course will be delivered through lectures, class room interaction and exercises.

Course Outcome:

On successful completion of the course the student will be able to:

1. Determine the dimensions of objects using measuring instruments and analyze vector in mechanics.
2. Create knowledge of properties of matter applicable to engineering.
3. Apply the concepts of thermal properties of matter and gas laws related to engineering.
4. Analyse the different concepts of waves and vibration in the field of engineering.
5. Analyse the recent trends in physics related to engineering.
6. Apply the basic concepts of chemistry in the field of engineering.

Mapping Course Outcomes with Program Outcomes:

CO –PO mapping

	Course Outcome	PO Mapped	Cognitive Level	Theory Sessions	Allotted marks on cognitive levels			TOTAL
					R	**U**	**A**	
CO1	Determine the dimensions of objects using measuring instruments and analyze vector in mechanics	**1,2,3,4,9**	**R/U/A**	**08**	8	10	6	**24**
CO2	Create knowledge of properties of matter applicable to engineering.	**1,2**	**R/U/A**	**10**	6	15	6	**27**
CO3	Apply the concepts of thermal properties of matter and gas laws related to engineering	**1,2,3,9**	**R/U/A**	**07**	4	10	6	**20**
CO4	Apply the different concepts of waves and vibration in the field of engineering.	**1,2,3,9**	**R/U/A**	**10**	4	10	18	**32**
CO5	Apply the recent trends in physics related to engineering.	**1,2,6**	**R/U/A**	**07**	4	10	6	**20**
CO6	Apply the basic concepts of chemistry in the field of engineering.	**1,2,6**	**R/U/A**	**10**	4	20	6	**30**
		Total Hours of instruction		**52**	Total marks			**153**

R-Remember; U-Understanding; A-Application

Course outcomes –Program outcomes mapping strength

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Applied Science	3	3	3	1	-	2	-	-	2	-

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Reference Books:

1. Principle of physicsfor class XI and XII by V.K.Mehata and Rohit Mehta, as per Karnataka state PUC syllabusS.Chand and Company, New Delhi
2. Engineering chemistry for Diploma by Ranjan Kumar Mahapatra (PHI Learning Pvt. Ltd., New Delhi)
3. Basic Physics by Kongbam Chandramani Singh (PHI Learning Pvt. Ltd., New Delhi)
4. Principle of physics by P.V.Naik (PHI Learning Pvt. Ltd. New Delhi)

Website:

1. www.rsc.org/Education/Teachers/resources/Inspirational/.../4.3.1.pdf
2. www.nanogloss.com/nanotechnology/advantages and disadvantages
3. www.freebookcentre.net/physics/ introductory-physics-books.html

e-books:

1. Introduction to physics – II, Robert P Johnson.
2. Lecture notes physics university of Rochester.
3. Text book of Physics poynting J.H Thomson sir J.J.

Course Assessment and Evaluation:

	What		To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	**CIE (Continuous Internal Evaluation)**	I A Tests	Students	Three tests (average of three tests will be computed)	20	Blue Books	1 to 6
		Class room Assignments		Two Assignments based on CO's (Average marks of Two Assignments shall be rounded off to the next higher digit.)	05	Log of Activity	1 and 6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	100	Answer Scripts at BTE	1 to 6
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course	Feedback forms		1 to 3 delivery of the course
	End Of Course Survey			End Of The Course	Questionnaire		1 to 6 Effectiveness of delivery of instructions and assessment

 ***CIE** – Continuous Internal Evaluation   ***SEE** – Semester End Examination
Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**APPLIED SCIENCE**	20
	Year:	Course code:15SC03S	

Name of Course coordinator :   Units:__ CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal Choice may be given for each CO at the same cognitive level (CL).

Question Paper Blue Print:

Course Title	:APPLIED SCIENCE	Course Code : 15SC03S

Name and Unit No.	Allotted Hours	Questions to be set for (2marks) PART - A	Questions to be set for (5marks) PART - B	Questions to be set for (6marks) PART - C
Mechanics **I**	08	04	02	01
Properties of Solids and Liquids **II**	10	03	03	01
Heat and properties of gases **III**	07	02	02	01
Wave motion **IV**	10	02	02	03
Modern Physics **V**	07	02	02	01
Industrial chemistry **VI**	10	02	04	01
Total	**52**	**15**	**15**	**8**

Guidelines for Question Paper Setting:

1. The question paper must be prepared based on the blue print without changing the weightage of model fixed for each unit.
2. The question paper pattern provided should be adhered to

Part – A: 10 questions to be answered out of 15 questions each carrying 02 marks

Part – B: 10 questions to be answered out of 15 questions each carrying 05 marks.

Part – C: 05 questions to be answered out of 08 questions each carrying 06 marks.

Model Question Paper:

<div align="right">**Code:15SC03S**</div>

I Semester Diploma Examination
APPLIED SCIENCE
(Common for All Engineering Programmes)

Time: 3 Hours][Max Marks: 100

*Note***:** i) Answer any 10 questions from section A, each carry 02marks.
　ii) Answer any 10 questions from section B, each carry 05 marks.
　iii) Answer any 05 questions from section C, each carry 06 marks.

SECTION – A

1. Define Unit.
2. Differentiate scalars and vectors.
3. Define Resultant of forces.
4. Define moment of couple.
5. Define plasticity.
6. Define compressibility.
7. Define viscosity of liquid.
8. Define specific heat of substance.
9. Define thermodynamics.
10. Define time period.
11. Define beats.
12. Define Electro-magnetic waves.
13. Define Nano-Technology.
14. Define electrolyte.
15. Define composite materials.

PART-B

1. Draw a neat diagram of Vernier calipers and label its parts.
2. Write the condition for equilibrium of coplanar parallel forces with an example.
3. Explain stress-strain graph.
4. Define K.E of liquid in motion. State Bernoulli's theorem.
5. Define capillarity? Write any three application of surface tension.
6. State 1st law of thermodynamics. Explain isothermal & adiabatic process.
7. State the three gas laws.(Boyle's law, Charle's law & Gay-Lussac law)

8. Explain mechanical &non- mechanical waves with examples.
9. Distinguish between longitudinal & transverse waves.
10. Write any three advantages and two disadvantages of F.M.
11. Write the principle of laser. Lists its properties.
12. Explain the mechanism of electrolysis of HCL.
13. Write the basic concepts of batteries. Mention any three applications of batteries.
14. Distinguish between minerals and ore. Write any three applications of pH.
15. Define composite materials. Write the advantages of composite materials.

PART-C

1. Derive an expression for magnitude and direction of resultant of two forces acting at a Point.
2. Describe an experiment to determine coefficient of viscosity of water by Poiseuille's method.
3. 1.25cc volume of a gas at 15^0C &755mm of mercury pressure. Calculate volume at NTP.
4. Derive an expression for fundamental frequency of transverse vibrations of stretched string.
5. Describe an experiment to find the unknown frequency of the given tuning fork using sonometer by comparison method.
6. Calculate the velocity of sound in air at 25^0C & 75cm of mercury pressure, if the density of air at 0^0C & 76cm of mercury pressure is 1.29kgm^{-3}. (given γ=1.41 for air).
7. Write the basic elements of communication system with block diagram.
8. Explain any two methods of polymerization.

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Model Question Bank:

Course Title :APPLIED SCIENCE	Course Code : 15SC03S

UNIT – I : MECHANICS

PART – A (02MARKS QUESTIONS)

1. Define unit of a physical quantity.
2. Define fundamental and derived units.
3. List supplementary units in S.I systems.
4. Define S.I units give two eg of S.I, basic units.
5. Define least count of measuring instrument.
6. Write the principle of Vernier calipers and screw gauge.
7. Define least count of Vernier calipers?
8. Define pitch of a screw.
9. Define ZE and ZC in screw gauge.
10. Define scalar quantity & give its examples.
11. Define vector quantity & give its examples.
12. Write the relation between resultant and equilibrant.
13. State law of parallelogram of vectors.
14. State Converse law of triangle of forces.
15. State Lami's theorem.
16. Define moment of force.
17. Write the two rectangular component of a vector.
18. Write how moment of force is measured.
19. Discus why the handles of the doors and windows are fixed at the end.
20. Define couple.
21. Define is moment of couple.
22. Write how you measure moment of couple.
23. Define equilibrium.
24. Write the conditions of equilibrium when number of co-planar parallel forces acting on a body.
25. Define like & unlike parallel forces.

PART – B   (05 MARKS QUESTIONS)

1. Mention seven basic units and   two supplementary units of SI system.
2. Draw a neat diagram of Vernier calipers and label its parts.
3. Draw a neat diagram of Screw Gauge and label its parts.
4. Explain parallel forces with their types.

5. List two types of moment of force. Write any three applications of couple.
6. Write the advantages of S.I system.
7. Mention the difference between scalars and vectors.
8. State Converse law of triangle of forces; write the line diagram & equation of Converse law of triangle of forces.
9. State Lami's theorem, write the line diagram & equation of lami's theorem
10. Define moment of force, write the equation to measure moment of force & give its examples.

PART – C (06 MARKS QUESTIONS)

1. Derive an expression for magnitude and direction of resultant of two forces acting at a point.
2. Derive an expression for horizontal and vertical components of force acting at an angle θ with horizontal.
3. Write the conditions for equilibrium of coplanar parallel forces acting on a rigid body with equations & diagram.
4. Describe an experiment to verify law of parallelogram of forces.
5. Describe an experiment to verify Converse law of triangle of forces.
6. Describe an experiment to verify Lami's theorem.
7. Describe an experiment to verify the conditions of equilibrium of co-planar parallel forces using moment bar.
8. A main scale is divided into 0.5 mm the length of vernier attached to it is 12mm and is divided into 25equal parts. Calculate the value of 1vsd and L.C of vernier.
9. In Vernier calipers, main scale is divided into 1mm;9division of main scale is divided into 10 equal parts on Vernier scale. In a setting zero of Vernier scale lies between 4.8cm and 4.9cm, and 7th division of vernier coincide with the main scale division. What is the total reading?
10. A screw gauge has a pitch of 0.5mm and 50 divisions on head scale. The reading when jaws touch is +5div. When gripping a wire the reading is 3 turns and 17 div. What is the diameter of the wire?
11. The resultant of two equal forces acting at a right angle to each other is 1414N.Findthe magnitude of each force.
12. Two forces of 5kg wt. and 10kg wt. acts at right angles to one another. Find the magnitude and direction of the resultant forces.
13. Two unlike parallel forces equal to 20N and 12N acts at two points A and B on a rigid body. Find the magnitude and direction of their resultant and the point where it acts if AB=0.8m
14. Two like parallel forces equal to 80N and 100N act on a body at two points A and B. If AB=0.6m,find the magnitude and the point where there resultant acts.
15. Three forces P, Q and 100 N acting on a body in equilibrium. If the angles opposite to P and Q are 120^0 and 150^0 respectively. Find the magnitude of P and Q.

UNIT II: PROPERTIES SOLIDS & LIQUIDS

PART – A (02MARKS QUESTIONS)

1. Define plasticity.
2. Define elasticity.
3. Define deforming force.
4. Define restoring force.
5. Define stress.
6. Write the types of stress.
7. Define strain.
8. Write the type of strain.
9. Define elastic limit.
10. State Hooke's law.
11. Define Young's modulus.
12. Define Bulk modulus.
13. Define Rigidity modulus.
14. Define compressibility? Write its S.I unit.
15. Write S.I units of stress and strain.
16. Define pressure of liquid.
17. Write equation for the pressure at a point inside the liquid at rest.
18. State Bernoulli's theorem.
19. Define cohesive force.
20. Define Adhesive force.
21. Write reason why glue stick to paper?
22. Define angle of a contact.
23. Name the type of angle of a contact formed for water and glass, water and mercury.
24. Define surface tension.
25. List the factors affecting surface tension.
26. Define capillarity.
27. Write any four applications of capillarity.
28. List the applications of surface Tension.
29. Write the equation used to determine surface tension of water by capillary raise method.
30. Define viscous force.
31. Give two examples of viscous liquid.
32. Define co-efficient of viscosity. Write its S.I unit.
33. List the factors affecting viscosity of liquid.
34. Write the effect on viscosity of gas if temperature is increased.
35. Write any four applications of viscosity.
36. List the types of flow of liquid.

PART – B   (05 MARKS QUESTIONS)

1. Explain elasticity with an example.
2. Define elasticity and list three types of modulei of elasticity.
3. Define strain. Write the types of strain. Give e.g. for each type of strain.
4. Define stress. Write the types of stress. Give e.g. for each type of stress.
5. Define elastic limit. State Hooke's law? Write its mathematical form .
6. Explain stress-strain graph.
7. Define compressibility and factor of safety. Write the SI unit of stress.
8. Define thrust and pressure, write their SI units.
9. Define K.E and P.E of liquid. State the Bernoulli's theorem.
10. Define cohesive and adhesive force with an example.
11. Define pressure energy and angle of contact.
12. Define two types of flow of liquid with an example.
13. Define angle of a contact. What type of angle of contact is formed for water and glass, water and mercury? List the factors affecting surface tension.
14. Define capillarity. Write any four applications of capillarity.
15. Write the difference between stream line flow and turbulent flow of liquids.
16. Define viscosity and write the effect of temperature on viscosity of liquid & gas.
17. Define stress and explain the types of stress.
18. Define strain and explain the types of strain.
19. State Hooke's law? List any three applications of viscosity.
20. Define surface tension. Mention any three factors affecting surface tension.

PART – C (06 MARKS QUESTIONS)

1. Derive an expression for young's modulus of elasticity.
2. Derive an expression for pressure at any point inside the liquid at rest.
3. Derive an expression for co-efficient of viscosity of liquid.
4. Describe an   experiment to determine   the surface tension of water by capillary rise method.
5. Describe an   experiment to determine coefficient of viscosity of water by Poiseuille's method.
6. A uniform wire of length 0.5m and diameter 0.0006m when stretched by a mass of 5kgextends by 0.0004m. Calculate Young's modulus of wire.
7. A wire of length 1m is fixed at one end and a mass of 1kg is hung from free end, the area of cross section of the wire is 2.5×10^{-6} m^2 and the Young's modulus of the material of the wire is 2×10^{11} Nm^{-2}. Calculate stress, strain and extension of the wire.
8. A spring 60cm long is stretched by 2cm by the application of a load 200g. What will be the length when the load of 500g is applied (given g = 980cm/s^2).

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9. A rectangular tank is 3m long,2m wide and 1.5m in height, it contains water to a depth of 1m,the density of water is 1000kg/m³. Calculate the pressure at the bottom of the tank.

10. Calculate the pressure at the bottom of a swimming pool 10m wide if the water is 3m deep, the density of water is 1000kg/m³.

11. A square plate of 6cm side moves parallel to another plate with a velocity of 10cm/s, both the plates being immersed in water ($\eta = 0.01$poise). If the distance between the plates 0.5mm.Calculate the viscous force.

12. In a certain experiment on the flow of water through a capillary tube, the following data were obtained. Volume of water coming out per minute = 15cc; pressure head of water = 30cm
Length of tube = 25cm; radius of tube = 0.05cm; calculate coefficient of viscosity of water(g=980cm/s², density=1gm/cc)

13. A castor oil of viscosity 98.6NS/ m² fills the space between two horizontal plates1cm apart. If the lower plate is stationary and upper plate is moving horizontally with a velocity of 3m/s . Find the tangential force per unit area.

UNIT-III: HEAT AND PROPERTIES OF GASES.

PART – A (02MARKS QUESTIONS)

1. Define heat & write SI unit of heat.
2. Define temperature & write SI unit of temperature.
3. Define specific heat of substance & write its SI unit.
4. Define conduction of heat.
5. Define convection of heat.
6. Define Radiation of heat.
7. Define Thermal conductivity.
8. Define specific heat of a gas at constant volume.
9. Define specific heat of a gas at constant pressure.
10. State Boyle's law.
11. State Charle's law.
12. State Gay-Lussac's law
13. Define isothermal process.
14. Define adiabatic process.
15. Define thermodynamics.
16. State zeroth law of thermodynamics.
17. State I[st] law of Thermodynamics.
18. State IInd law of Thermodynamics
19. Write Mayer's equation.

PART – B (05 MARKS QUESTIONS)

1. Write any five differences between heat & temperature.

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2. Define heat, temperature & specific heat of Substance. Write Mayer's equation for gas.
3. Define conduction, convection, radiation and thermal conductivity.
4. Write any five applications of conduction.
5. Write any five applications of convection.
6. Write any five applications of radiation.
7. Define Cp & Cv , write the relation between them.
8. Define conduction, write applications of conduction.
9. Define convection, write applications of convection.
10. Define radiation, write applications of radiation..
11. State 1st law of thermodynamics, explain isothermal & adiabatic process.
12. Derive an expression for coefficient of thermal conductivity (K).
13. Compare the three modes of transfer of heat.
14. State the three gas laws. (Boyle's law, Charle's law & Gay-Lussac's law).
15. State zeroth law, 1st law& 2nd law of thermodynamics.

PART – C (06 MARKS QUESTIONS)

1. With usual notations prove that pv = nRT
2. Define thermal conductivity. Derive an equation for co-efficient of thermal conductivity (K).
3. Define specific heat of a substance. Derive an equation for specific heat of substance.
4. Describe an experiment to verify Boyle's law.
5. The volume of a gas at 27^0c at2 atmospheric pressure is 2 liters.
    If the pressure is double & absolute temperature is reduced to half.
    What will be the new volume of gas?
6. A sealed glass bulb contains air at 30^0C at normal pressure. The bulb is immersed in an oil bath &heated gradually. Find the temperature in degree centigrade at which the bulb bursts if it can withstand a maximum pressure of 3.5atm.
7. The volume of certain mass of a gas at STP is 2×10^{-4} m^3. Find its volume at 27 ^{0}C at pressure 2.2×10^5 Pa.
8. The volume of a gas at 15^0C is1.25cc   &755mm of mercury pressure. Calculate volume at NTP.
9. How much heat is required to raise the temperature of 5kg of copper from 27^0C to its melting point of 1063^0C? Given that specific heat of copper is 400 J/k^{0}C.
10. A hot iron ball of mass 0.2kg is dropped into 0.5g of water at 10^0C. The resulting temperature is 30^0C. Calculate the temperature of the hot ball. Specific heat of iron = 336J/kg^{0}C and specific heat of water = 4200J/kg^{0}C.
11. A silver rod 0.15m long has cross-sectional area of 0.0003m^2. If one end is maintained at 10^0C and other end at 75^0C. How much heat will flow through the rod in 5 minutes? Given that co-efficient of thermal conductivity of silver = 406 J/ms^{0}C.

UNIT-IV: WAVE MOTION

PART – A (02MARKS QUESTIONS)

1. Define frequency and amplitude of a vibrating particle.
2. Wrote   the relation between frequency and time period.
3. Define periodic motion with example.
4. Define S.H.M with example.
5. Write the equation for displacement of the particle in S.H.M.
6. Define wave motion.
7. Define wave period, wave frequency.
8. Write the relation between wave velocity, wavelength & wave frequency
9. Define non mechanical wave. Give an example.
10. Define mechanical wave. Write two types of Mechanical wave
11. Define transverse wave & give an example.
12. Define longitudinal wave & give an example.
13. Write any two differences between transverse wave and longitudinal wave.
14. Write two characteristics of transverse wave.
15. Write two characteristics of longitudinal wave.
16. Write Newton's equation for velocity of sound in a medium and name the terms involved in the equation.
17. Write the Newton's Laplace equation for velocity of sound in air
18. Write the effect of pressure on velocity of sound in air.
19. Write the effect of temp on velocity of sound in air.
20. Write the equation for velocity of sound in air at 0°c.
21. Write the effect of humidity on velocity of sound in air.
22. Define free and forced vibration.
23. Define natural frequency.
24. Define resonance.
25. Give any two practical examples of resonance.
26. Define how stationary waves are produced?
27. Write any two characteristics of stationary waves.
28. Define nodes and antinodes.
29. Write the difference between stationary waves and progressive waves.
30. Write the fundamental note in vibration of stretched string.
31. Write the formula for the fundamental frequency of vibration of stretched string.
32. State the law of tension as applied to the vibration of stretched string.
33. State the law of length as applied to the vibration of stretched string.
34. State the law of mass per unit length as applied to the vibration of stretched string.
35. Define beats.
36. Define beat frequency.
37. Write any two applications of beats.

38. Write how beat frequency can be calculated?

PART-A   (05 MARKS QUESTIONS)

1. Define period, frequency & amplitude of vibrating particle.
2. Explain mechanical &non mechanical waves with examples.
3. Define longitudinal waves & transverse waves.
4. Define beat and beat frequency.
5. Obtain the relation between v, n and λ.
6. Define periodic motion & SHM with example in each.
7. Derive an expression for displacement of a particle executing SHM.
8. Define wave period, wave frequency, wave amplitude, wave length and wave velocity.
9. Distinguish between longitudinal & transverse waves.
10. Explain propagation of sound waves in air with practical example.
11. Describe Newton's formula for velocity of sound in air.
12. Explain Newton's formula for velocity of sound in air and hence Laplace correction to it.
13. Explain various factors affecting velocity of sound in air.
14. What is stationary wave? Mention the characteristics of stationary waves.
15. Why the soldiers are asked to break steps while marching across bridges.

PART- C (06 MARKS QUESTIONS)

1. Derive an expression for displacement of a particle executing SHM
2. Derive an expression for velocity of wave in terms of its frequency and wavelength.
3. Derive an expression for fundamental frequency of vibrations of stretched string.
4. Describe an experiment to determine the velocity of sound in air at room temperature by resonance air column method.
5. Describe an experiment to find the unknown frequency of the given tuning fork using sonometer by comparison method.
6. Describe an experiment to determine frequency of Turing fork by absolute method using sonometer.
7. A wave of frequency 600MHZ travels at a speed of 3×10^8 m/s. Calculate its wavelength &calculate the frequency of same type of wave whose wavelength is 40m.
8. If the frequency of tuning   fork is 500Hz & velocity of sound is 300m/s. Find how far sound travels while the fork completes 25 vibrations.
9. Calculate the velocity of sound in air at $25^0 C$ & 75cm of mercury pressure, if the density of air at $0^0 C$ & 76cm of mercury pressure is 1.29kgm^{-3}. (Given γ=1.41 for air).
10. Calculate the speed of sound at -50^0 C & at $+100^0 C$, given speed of sound   at $0^0 c$ is 332 m/s.
11. The density of air at NTP is 1.293 kgm^{-3}&γ=1.402. Calculate the frequency of a tuning fork which emits sound of wavelength 0.75m at 26^0 c.
12. A string of length 2m is stretched by a force of 3200N. If the frequency of vibration is

100Hz. Find the mass of the string.

13. A string has length of 0.3m & weight 2×10^{-3}kg. What must be the tension in the string so that when vibrating string transversely, it has a fundamental frequency 320 Hz?

14. A Sonometer wire of 0.5m long vibrates in two segments & is stretched by a force of 5kg wt. Calculate the frequency of the note emitted. ($g=9.8 m/s^2$ linear density of the wire=0.018kg/m).

15. The frequency of Sonometer wire is doubled when the tension is increased by 12kg wt. Find the original tension.

UNIT V: MODERN PHYSICS

PART – A (02MARKS QUESTIONS)

1.   Define electromagnetic waves.
2.   State two characteristics of electromagnetic waves.
3.   Write how electromagnetic waves are produced?
4.   Define electromagnetic spectrum.
5.   Write any two uses of electromagnetic spectrum.
6.   Write the principle of LASER.
7.   List any two types of LASER.
8.   Write any two principle of LASER.
9.   Write any two applications of LASER.
10. Define nanotechnology.
11. Write two advantages of nanotechnology.
12. Write two disadvantages of nanotechnology.
13. Write what do you mean by communication?
14. Write the basic elements of communication system.
15. List any two commonly used terms in electronic communication system.
16. Write two advantages of communication satellite.
17. Write two disadvantages of communication satellite.
18. Define optical fiber.
19. Write the principle of optical fiber.
20. Write two advantages of optical fiber.

PART-B   (05 MARKS QUESTIONS)

1.   Describe the generation of electromagnetic waves.
2.   Write any five properties of electromagnetic waves.
3.   Explain how electromagnetic spectrum is classified?
4.   Write any five applications of electromagnetic spectrum.
5.   Explain the principle of LASER. List the properties of LASER.
6.   Write any five advantages of LASER.
7.   Write five advantages of nanotechnology.
8.   Write advantages and disadvantages of nanotechnology.

9. Write the block diagram of communication system.
10. List any five commonly used terms in electronic communication system..
11. Write five advantages of satellite communication.
12. Write any five disadvantages of satellite communication.
13. Write any five advantages of optical fiber.
14. Explain satellite communication. List any two disadvantages of satellite communication system.

PART- C (06 MARKS QUESTIONS)

1. Define electromagnetic waves. Write four properties of electromagnetic waves.
2. Define electromagnetic spectrum. Explain how electromagnetic spectrum is classified.
3. Write the applications of electromagnetic spectrum.
4. List six applications of LASER.
5. Write six advantages of nanotechnology.
6. Write what you mean by communication system. Write the block diagram of communication system..
7. Define satellite communication system. Write four advantages of satellite communication system.
8. Write the principle of optical fiber. Write four applications of optical fiber.

UNIT VI INDUSTRIAL CHEMISTRY

PART – A (02MARKS QUESTIONS)

1.Define electrolysis.
2.Define electrolyte.
3.Write any four examples of electrolyte.
4.Define strong and weak electrolyte.
5.Write any two postulates of Arrhenius theory of electrolytic dissociation.
6.State Faradays Ist law of electrolysis.
7.State Faradays IInd law of electrolysis.
8.Define corrosion.
9.List any two preventive methods of corrosion.
10.Define batteries.
11.Write any two applications of batteries.
12.Define fuel cells.
13.Write any two types of fuel cells.
14.Write any two advantages of fuel cells.
15.Define minerals.
16.Define ore.
17.Define flux.
18.Define slag.
19.Define an alloy.
20.Write any two uses of alloys.

21.Define polymers.
22.Define polymerization.
23.Write any two applications of polymers.
24.List the methods of polymerization.
25. Define composite materials.
26.Write any two types of composite materials.
27.Write two advantages of composite materials.
28. Write two disadvantages of composite materials.
29.Define solute.
30.Define solvent.
31.Define solution.
32.Define saturated solution.
33.Define unsaturated solution.
34.Define concentration of a solution.
35.Define normal solution.
36. Define molar solution.
37.Define molal solution.
38.Define pH of a solution.
39.Write any two applications of pH.
40.Write hydrogen ion concentration in case of neutral solution.

PART-B   (05 MARKS QUESTIONS)

1.Explain the mechanism of electrolysis of HCl.
2.Define corrosion. Write the necessary condition of corrosion.
3.Write any five postulates of Arrhenius theory of electrolytic dissociation.
4.State Ist and IInd Faradays laws of electrolysis.
5.Write any five preventive methods of corrosion.
6. Write the classification of batteries. Write two applications of batteries.
7. Write two types of fuel cells. List any three advantages of fuel cells.
8.Define alloys. Write the purpose of making alloys.
9. Write the classification of polymers. Write any three applications of polymers.
10.Define composite material. Write any two advantages of composite materials.
11. Calculate the concentration of solution when 110gmof copper sulphate is dissolved in
     550gm of a solvent.
12. Define pH of a solution. Explain acid, base, and neutral solution on the basis of pH value.

PART- C (06 MARKS QUESTIONS)

1. State and explain Faradays laws of electrolysis?
2. Explain the mechanism of electrolysis of HCL.
3. Define corrosion. Write the necessary condition for corrosion.
 4. Write any six preventive methods of corrosions.
 5. Explain the electrochemical theory of corrosion.

6. Mention what is battery? Write the applications of batteries.
7. Define fuel cells. Mention the types of fuel cells.
8. Write the advantages of fuel cells.
9. Define minerals, ore, flux, slag and alloys?
10. Write the composition steel. List three uses of alloys.
11. Explain any two methods of polymerization.
12. Write the applications of polymers.
13. Write the advantages and disadvantages of composite materials.
14. Define molar and normal solution. What is concentration of a solution?
15 .Write any six applications of pH.

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Government of Karnataka
Department of Technical Education, Bengaluru

Course: APPLIED SCIENCE
Course code: 15SC03S

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1	Mr. R B Pawar	Principal	Govt. Polytechnic, Bijapur
2	Mr. K.Nazeer Ahmed	Selection Grade Lecturer	Govt. Polytechnic, Mulbagilu
3	Mr. Liyakhat Ali Khan	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
4	Dr. HanumanthaNayak	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
5	Ms. Bhagirathi B N	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru

Curriculum Review Committee

	Name	Designation	Institution
1	Mr. K.Nazeer Ahmed	Selection Grade Lecturer	Govt. Polytechnic, Mulbagilu
2	Mr. Liyakhat Ali Khan	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
3	Smt. Revathi	Selection Grade Lecturer	M.E.I. Polytechnic, Bengaluru

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	Course Code	: **15EE01E**
Semester	: **I / II/ III**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **4:0:0** (in Hours)	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: 25 Marks	SEE	: **100 Marks**
Programme: Mechanical (GL), Mechanical (Instr.), MTT, HPT, WSM, Automobile, Mechatronics, Printing Technology, Textile Technology, Ceramics, Mining Engg., Metallurgical Engg., Aeronautical Engineering.			

Pre-requisites	:Mathematics and Science in Secondary Education.
Course Objectives	:To introduce the concept of electrical current, voltage, power, energy, electrical circuits, magnetic fields, electromagnetic induction and alternating current. Introduction of Transformers, DC Generators, AC Generators and Motors, protective devices and Earthing. Introduction to Battery, UPS, electronic components and their applications.

Course Unit-wise Weightage of Marks:

Unit Nos.	Topics	Teaching Hours	SEE Max. Marks
1	Electricity and DC Circuits	10	30
2	Electromagnetism and DC Generators	6	15
3	AC Fundamentals, Transformers and AC Generators	10	30
4	Electric Motor Drives	9	25
5	Protective Devices, UPS and Estimation	8	20
6	Electronic Components and Applications	9	25
	Total	52	145

Course Outcomes

On successful completion of the course, the student will be able to:

1. Understand basics of Electricity and Ohm's law and DC circuits
2. Understand Faraday's laws of electromagnetic induction and DC Generator.
3. Understand AC fundamentals, AC generator and Transformer.
4. Differentiate the applications of DC & AC motors , necessity of starters.
5. Understand protective devices like Fuses, MCB, and ELCB and earthing and safety measures, Batteries and UPS.
6. Understand electronic components and their applications, working of rectifiers and logic gates.

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)	Total Marks (145)
1	Remembering	10	15
2	Understanding	70	100
3	Application	20	30
Total		**100**	**145**

Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand basics of Electricity and Ohm's law and DC circuits	*R/U/A*	1,2,10	10
CO2	Understand Faraday's laws of electro-magnetic induction and DC Generator.	*R/U*	1,2,10	6
CO3	Understand AC fundamentals, AC generator and Transformer.	*R/U/A*	1,2,10	10
CO4	Differentiate the applications of DC & AC motors, necessity of starters.	*R/U*	2,10	9
C05	Understand protective devices like Fuses, MCB, and ELCB and earthing and safety measures, Batteries and UPS.	*U/A*	1,2,10	8
C06	Understand electronic components and their applications, working of rectifiers and logic gates.	*U/A*	1,2,10	9
			Total sessions	**52**

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE:

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for (5marks) PART - A			Questions to be set for (10marks) PART - B			Marks weightage (%)
				R	U	A	R	U	A	
1	Electricity and DC Circuits	10	30	1	1	-	-	1	1	20
2	Electromagnetism and DC Generators	6	15	1	-	-	-	1	-	10
3	AC Fundamentals, Transformers and AC Generators	10	30	1	-	1	-	2	-	20
4	Electric Motor Drives	9	25	-	1	-	1	1	-	18
5	Protective Devices, UPS and Estimation	8	20	-	1	1	-	1	-	14
6	Electronic Components and Applications	9	25	-	1	-	-	1	1	18
	Total	**52**	**145**	**9 (45 Marks)**			**10 (100 Marks)**			**100**

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Basic Electrical and Electronics Engineering.	3	3	-	-	-	-	-	-	-	3

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.
METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
IF < 5% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS CONSIDERED NOT-ADDRESSED.

Course Content:

Unit 1

Electricity and DC Circuits: Introduction to sources of electrical energy, advantages, effects of electric current and its applications. Electrical current, voltage, emf, potential difference, electric work, power, energy & their units and measuring instruments. Conductors, insulators and semiconductors. Resistance, Ohm's law and limitations, Problems on ohms law. .Problems on power and energy. Resistances connected in series, parallel, series and parallel combinations. Simple problems on resistance combinations..Horse Power and BHP

Unit 2

Electromagnetism: Magnetic field, Magnetic flux, Magneto motive force, flux density, Reluctance and their units. permeability. Faraday's laws, statically and dynamically induced EMF, self and mutual induced emf. Inductance, mutual inductance and their units.
DC Generator: Construction and working.

Unit 3

Fundamentals of AC Circuits: Sinusoidal voltage, current, amplitude, time-period, cycle, frequency, phase, phase difference, RMS value, Average value, form factor, and their units. Simple Problems. Capacitance, capacitive reactance, inductive reactance, impedance and their units. Power, power factor and units. Problems on reactance, impedance , power and power factor in series R-L,RC,RLC circuits. Difference between single phase and three phase power. Advantages of three phase power over singe phase power.
Transformers: construction working, application, ratings.
AC Generators: construction working, applications, ratings.

Unit 4

Electric Motor Drives: DC motors, types, applications and selection criteria. AC motors, single and three phase motors, selection criteria, FHP motors applications and selection criteria, applications of single phase and three-phase motors. Name plate details of single phase and 3 phase motors. Necessity of starters for AC motors, types and applications. Advantages of 3 phase motors over single phase motors. List out the motors used for following purposes; Mining, Printing, Textiles, Cement, Mechanical, Aeronautical and Chemical industries by giving selection criteria. Importance of Motor enclosures, types, and their applications.

Unit 5

Protective Devices, UPS& Estimation: Necessity of protective devices, ratings, rewireable, cartridge, and HRC fuses. Types of switches, MCB and ELCB. Necessity of electrical earthing and types. General safety precautions to prevent electrical accident, first aid in electric shock. Cell, battery, types of batteries, conditions of fully charged and discharged battery of lead acid battery, sealed maintenance free (SMF) battery. Selection of batteries.UPS, types, applications and selection criteria of UPS.
i)Plan and estimate the cost of electrical wiring for one 3mX3m room having consisting of 2 tube lights, 1 ceiling fan, 2 three pin socket.

ii) Plan and estimate the cost of electrical wiring for one lathe for three phase wiring with MCBs, starters, Iron clad switches, and HRC fuses.

Unit 6

Electronic Components and Applications: Intrinsic and extrinsic semiconductors, P and N type materials. Diode, types and their applications. Forward and Reverse bias characteristics of a Diode. Half wave ,full wave and bridge rectifiers without filter. Zener diode as a voltage regulator. Transistor (BJT)working, applications, and transistor as a switch.SCR working and industrial applications. Timers, applications. Relays, applications. Logic gates – OR,AND,NOT, EX-OR, NAND, and NOR, meaning and advantages of IC.

Reference Books:

1. ABC of Electrical Engineering by B. L. Theraja and A. K. Theraja, S Chand Publishers, New Delhi, 2014 Edition.
2. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Education India, 2012 Edition.
3. Electronic Devices and Circuits by I. J. Nagrath, PHI Learning Pvt. Ltd., 2007 Edition.
4. Basic Electrical Engineering byV. Mittle and ArvindMittle, McGrawHill Companies, 2005 Edition.

e-Resources

5. http://jenko.eu/marjan/fpp_izredni/knjiga_df/df_1_digital_concepts.pdf
6. http://www.facstaff.bucknell.edu/mastascu/elessonshtml/eeindex.html - Welcome to Exploring Electrical Engineering.
7. Fundamentals Handbook of Electrical Science, Module 1, Basic Electrical Theory, Department of Energy, U. S. Department of Energy, June 1992.
8. http://www.freeengineeringbooks.com/Electrical/Basic-Electrical-Engineering.php
9. http://www.electrical-engineering-portal.com

Course Contents with Lecture Schedule:

Lesson No./ Session No.	Contents	Duration
	Electricity and DC Circuits:	**10 Hours**
1.	Introduction to sources of electrical energy, advantages,	01 Hour
2.	Effects of electric current and its applications.	01 Hour
3.	Electrical current, voltage, emf, potential difference	01 Hour
4.	Electric work, power, energy & their units and measuring instruments.	01 Hour
5.	Problems on power and energy	01 Hour
6.	Conductors, insulators and semiconductors. Resistance.	01 Hour
7.	Ohm's law and limitations.	01 Hour
8.	Problems on ohms law	01 Hour
9.	Resistances connected in series, parallel, series and parallel combinations. Horse Power and BHP.	01 Hour
10.	Simple problems on resistance combinations.	01 Hour
	Electromagnetism and DC Generator	**6 Hours**
11.	Magnetic field, Magnetic flux, Magneto motive force	01 Hour
12.	Flux density, Reluctance and their units. Permeability.	01 Hour
13.	Faraday's laws, Statically and dynamically induced EMF,	01 Hour
14.	Self and mutual induced emf.	01 hour
15.	Inductance, mutual inductance and their units.	01 Hour
16.	DC Generator- construction and working	01 Hour
	Fundamentals of AC Circuits, Transformers, and AC Generators	**10 Hours**
17.	Sinusoidal voltage, current, amplitude, time - period, cycle, frequency,	01 Hour
18.	Phase, phase difference, RMS value, Average value, form factor, and their units. Problems on sinusoidal wave.	01 Hour

Lesson No./ Session No.	Contents	Duration
19.	Capacitance, capacitive reactance, inductive reactance, impedance and their units.	01 Hour
20.	Power, power factor and units. Difference between single phase and three phase power.	01 Hour
21.	Problems on reactance, impedance , power and Power factor.	01 Hour
22.	Advantages of three phase power over single phase power	01 Hour
23.	Transformers- construction and working,	01 Hour
24.	Transformers- ratings and applications.	01 Hour
25.	AC Generators- construction working,	01 Hour
26.	AC Generators-ratings and applications.	01 Hour
	Electric Motor Drives	**9 Hours**
27.	DC Motors, types, applications	01 Hour
28.	Selection criteria of DC motors.	01 Hour
29.	AC motors, single and three phase, Advantages of 3 phase motors over single phase motors.	01 Hour
30.	Selection criteria for AC motor selection	01 Hour
31.	FHP motors applications and selection criteria,	01 Hour
32.	Applications of single phase and three-phase motors.	01 Hour
33.	Name plate details of single phase and 3 phase motors. Necessity of starters for AC motors, types and applications.	01 Hour
34.	List out the motors used for following purposes; Mining, Printing, Textiles, Cement, Mechanical, Aeronautical and Chemical industries by giving selection criteria.	01 Hour
35.	Motor enclosures, importance and their applications.	01 Hour
	Protective Devices, Batteries ,UPS and Estimation	**8Hours**
36.	Necessity of protective devices. Types	01 Hour

Lesson No./ Session No.	Contents	Duration
37.	Rewire-able fuse, fuse cartridge, and HRC fuse. Types of switches, MCB and ELCB. and Ratings of protective devices.	01 Hour
38.	Necessity of electrical earthing and types. General safety precautions and electric shock treatment.	01 Hour
39.	Cell, battery, types of batteries, conditions of fully charged and discharged battery of lead acid battery	01 Hour
40.	Sealed maintenance free (SMF) battery. Selection of batteries.	01 Hour
41.	UPS, types, applications and selection criteria of UPS.	01 Hour
42.	Plan and estimate the cost of electrical wiring for one 3mx3m room consisting of 2 tube-lights, 1ceiling fan, 2 three pin socket.	01 Hour
43.	Plan and estimate the cost of electrical wiring for One lathe for three phase wiring with MCBs, starters, Iron clad switches, and HRC fuses.	01 Hour
	Electronic Components and Applications	**9 Hours**
44.	Intrinsic and extrinsic semiconductors, P and Ntype materials.	01 Hour
45.	Diode, types and their applications. Forward and Reverse bias characteristics of a Diode.	01 Hour
46.	Half wave and full wave bridge rectifiers without filter.	01 Hour
47.	Zener diode as a voltage regulator. Transistor (BJT) -working,	01 Hour
48.	Transistor types, applications, and transistor as a switch.	01 Hour
49.	SCR working and industrial applications.	01 Hour
50.	Timers, applications.	01 Hour
51.	Relays, applications.	01 Hour
52.	Logic gates–OR,AND,NOT, EX-OR, NAND, and NOR, advantages and applications of IC.	01 Hour

Course Delivery:

The Course will be delivered through lectures, classroom interaction, animations, group discussion, exercises and assignments.

Course Assessment and Evaluation

			To Whom	**Frequency**	**Max Marks**	**Evidence Collected**	**Course Outcomes**
Direct Assessment	**CIE (Continuous Internal Evaluation)**	I A Tests	Students	Three IA tests for Theory: (Average marks of Three Tests to be computed).	20	Blue Books	1 to 6
		Classroom Assignments		Student Activities	05	Log of Activity	1 to 6
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End of the Course	100	Answer Scripts at BTE	ALL CO's
Indirect Assessment	Student Feedback on course		Students	Middle of The Course	Feed Back Forms		1-3 Co's
	End Of Course Survey			End of The Course	Questionnaires		All Co's

*CIE – Continuous Internal Evaluation   *SEE – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Suggested Student Activities:

Each Student has to prepare a self-hand written report of 3 pages or solved in a blue book considering any one of the following topics.

1. Using suitable meters/ instruments give the practical working circuits to measure Resistance, Current, Voltage, Power and Energy in DC and AC (Single phase) Circuits.
2. Report on different materials used for electromagnets with their properties.
3. Applications of Electro Magnetic Induction, statically induced and dynamically induced emf, self and mutual induced emfs.
4. Practical applications of Single Phase AC supply and Three phase AC supply with their operating voltages and other electrical parameters.
5. Report on types of starters and enclosures used for various industrial applications of AC motors.
6. Visit nearby Battery charging and inverter (UPS) shop or show room and prepare a report of the visit.
7. Visit nearby electronics shop/ market and identify the different diodes and rectifier with their ratings.
8. Prepare a wiring plan for a building/ lab/ room, etc.

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)										

Dimen sion	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks One activity on any one CO (course outcome) may be given to a group of FIVE students **Grand Average/Total**						14/4 =3.5 ≈4				

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Conensions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year		Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM			20
	Year:			
Name of Course coordinator : CO's:____				Units:__

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code		Max Marks
2nd Test/ 10th week, 9 Feb 16, 10-11 AM	I SEM, Mech. Engg.	**Basic Electrical and Electronics Engg.**		20
	Year: 2015-16	Course code: 15EE01E		

Name of Course coordinator:
Units Covered :3 and 4
Course Outcomes : 3 and 4
Instruction :(1). Answer all questions   (2). Each question carries five marks

Question No.	Question	CL	CO	PO
1	Define and state the units of i) Maximum value ii) Instantaneous value and iii) form factor.	R	3	1,2,10
2	Explain the construction of an AC Generator. OR A resistance of 100 Ω is connected in series with a capacitance of 150 µF. If this is connected to 200V, 50 Hz supply, find i) Impedance ii) Current and iii) Power factor	U A	3	1,2,10
3	State the necessity of Starters for AC Motors. List the types and applications.	R	4	2, 10
4	Explain the need of mechanical enclosures. List the types and applications. OR List out the applications of DC and AC Motors.	U U	4	2, 10

CL: Cognitive Level, R-Remember, U-Understand, A-Application, PO: Program Outcomes

Model Question Paper:

<div align="right">Code:15EE01E</div>

I /II Semester Diploma Examination
BASIC OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Common for Mechanical (GL), Mechanical (Instr.), MTT, HPT, WSM, Mechatronics, Printing Technology, Textile Technology, Ceramics, Mining Engg., Metallurgical Engg..)

Time: 3 Hours]   **[Max Marks: 100**

*Note***:**   i) Answer any SIX questions from PART - A. Each question caries 5 marks.
            ii) Answer any SEVEN Questions from PART - B. Each question caries 10 marks.

PART – A

1. State the Sources of Electrical Energy.

2. Define and mention the SI units of i) Electric Current ii) Voltage

3. State Faraday's First and Second Laws of Electromagnetic Induction.

4. Define i) RMS value ii) Average value and write equations.

5. State the working principle of a Transformer.

6. State Five applications of DC motors.

7. Write the name plate details of a three phase Induction Motor.

8. Distinguish between MCB and ELCB.

9. State the advantages of Integrated Circuits over discrete components.

PART – B

10. a. State Ohm's Law and mentions the limitations.   4
    b. Three resistances of 6 Ω, 4 Ω and 10 Ω are connected in series, across supply of 100 V, Find   i) Effective resistance of the circuit.
                    ii) Total current in the circuit.
                    iii) Current through each resistance   6

11. a. Define i) Electric Power ii) Electric Energy   and
       mention the meters used to measure them.   4
b. A house consists of two bulbs of 100W each, three bulbs of 60W each and one

fluorescent lamp of 40W. If they are used for 4 hours a day, find monthly consumption charges at Rs. 2.70 per unit.   6

12. a. Define with SI Units. i) Magnetic Flux ii) Magneto motive Force.   4
    b. Distinguish between Statically Induced and Dynamically Induced emf.   6

13. a. Explain the construction of DC Generator.   4
    b. Draw a sinusoidal waveform and mark the following
        i) Maximum value
        ii) Instantaneous value
        iii) cycle   6

14. a. State Five advantages of 3-phase power supply over 1-phase power supply.   5
    b. Explain the construction of an AC Generator.   5

15. a. State Five applications of FHP motors.   5
    b. State the necessity of starters for 3-phase induction motors and list the types.   5

16. a. State the advantages of three phase motors over single phase motors.   5
    b. Explain the need for different motor enclosures and state the applications.   5

17. a. State any five general electrical safety precautions.   5
    b. Mention the conditions for fully charged and discharged lead acid battery.   5

18. a. Explain the selection criteria of an un-interrupted power supply (UPS).   4
    b. Distinguish between Intrinsic and extrinsic semiconductors.   6

19. a. Explain the working of a full wave diode bridge rectifier with a neat sketch.   5
    b. Draw the logic symbol and write the truth table for

    i) NAND gate and ii) NOR gate.   5

Model Question Paper Bank

Course Title:	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	Course Code	: **15EE01E**

All the questions carry 5 marks each.

Unit 1 - Electricity and DC Circuits

Cognitive Level: REMEMBER

1.   State the Sources of Electrical Energy.
2.   State Five effects of Electrical Current with an example each.
3.   Define and mention the SI units of i) Electric Current   ii) Voltage.
4.   Define and mention the SI units of i) Potential Difference ii) Resistance
5.   Define i) Electric Current ii) Voltage and mention the meters used to measure them.

Cognitive Level: UNDERSTAND

6.   Mention any five applications of Electrical Energy.
7.   State five advantages of electrical energy over other forms of energy.
8.   Distinguish between Conductors and Insulators.
9.   Distinguish between Conductors and Semi-conductors.
10.   State Ohm's Law and mentions its limitations.
11.   State and explain Ohm's Law.
12.   Define Horse power and Brake Horse power

Cognitive Level: APPLICATION

13.   Determine the equivalent resistance of three resistances R1, R2 and R3 when
14.   connected in series across a supply voltage of V volts.
15.   Determine the equivalent resistance of three resistances R1, R2 and R3 when connected in parallel across a supply voltage of V volts.
16.   Three resistances of 6 Ω, 4 Ω and 10 Ω are connected in series, across supply of 100 V, Find i) Effective resistance of the circuit.
      ii) Total current in the circuit.
      iii) Current through each resistance
      iv) Voltage drop across each resistance.
17.   Define i) Electric Power ii) Electric Energy and mention the meters used to measure them.
18.   Define Electric Power and write the three equations of electrical power with current, voltage and resistance.
19.   A 100 watt lamp is used for 6 hours and a 60 watt lamp is used for 4 hours a day. Find   i) Energy consumed per month and

ii) Cost of energy if each unit costs Rs.2.70

20.   A house consists of two bulbs of 100W each, three bulbs of 60W each and one fluorescent lamp of 40W. If they are used for 4 hours a day, find monthly consumption charges at Rs. 2.70 per unit.

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Unit 2 – Electromagnetism

Cognitive Level: REMEMBER

21.   Define with SI units. i) Flux density ii) Reluctance.
22.   Define with SI units. i) Magnetic flux ii) Magneto Motive Force.
23.   Define with SI units i) Permeability ii) Reluctance.
24.   Define with SI units a) Inductance b) Mutual inductance

Cognitive Level: UNDERSTAND

25.   State Faraday's First and Second Laws of Electromagnetic Induction.
26.   Distinguish between Statically Induced and Dynamically Induced e.m.f.
27.   Distinguish between self-induced and mutual-induced e.m.f.
28.   Explain with a sketch statically induced emf with an example.
29.   Explain with a sketch dynamically induced emf with an example.
30.   Explain the construction of DC Generator.
31.   Explain the working of a DC Generator.

Unit 3 - Fundamentals of AC Circuits

Cognitive Level: REMEMBER

32.   Define i) RMS value ii) Average value and write equations.
33.   Define the following with reference to a sinusoidal waveform
    a) Maximum value
    b) Instantaneous value
    c) Form factor.
34.   Define with equations, i) Capacitive reactance ii) Inductive reactance.
35.   What is a transformer? State its applications.
36.   What is an AC generator? State its applications.
37.   Define with SI units. i) Frequency and ii) Time period.

Cognitive Level: UNDERSTAND

38.   Explain with illustration i) phase and ii) phase difference.
39.   Draw a sinusoidal waveform and mark the following
    i) Maximum value
    ii) Instantaneous value

iii) cycle

iv) Time Period.

40. The instantaneous value of current is given by i = 50 sin 520 t, find Instantaneous value at t = 5ms ,Maximum value, Frequency and Time period

41. Explain Impedance, mention the SI unit and also write the equation.

42. Explain the construction of an AC Generator.

43. State the working principle of a transformer.

Cognitive Level: APPLICATION

44. A resistance of 100 Ω is connected in series with a capacitance of 150 μF. If this is connected to a 200 V, 50 Hz supply, Find Capacitive reactance. Impedance of the circuit, Power factor, and Current

45. A resistance of 20 is connected in series with a inductance of 0.07 H . If this is connected to a 200V, 50 Hz supply, find Inductive reactance, Impedance, Power factor, and current

46. Define power factor and explain its effect on electrical power.

47. Compare between three phase power supply and single phase power supply.

48. State Five advantages of three phase power supply over single phase power supply.

49. Explain the working principle of an AC generator.

50. Explain the construction of a transformer.

51. Write the ratings of a typical transformer.

52. Write the ratings of a typical AC generator.

Unit 4 - Electric Motor Drives

Cognitive Level: REMEMBER

53. What is a DC motor? List the types of DC motors.

54. State five applications of DC motors.

55. What is an AC motor? List the types of AC motors.

56. State the applications of single phase AC motors.

57. State the applications of three phase AC motors.

58. State the necessity of starters for three phase induction motors and list the

59. types.

60. State the advantages of three phase motors over single phase motors.

Cognitive Level: UNDERSTAND

61. Explain briefly the selection of DC motors.

62. Compare single phase and three phase AC motors.

63. Explain briefly the selection of single phase and three phase AC motors.

64. What is FHP motor? List the applications of FHP motors.

65. Explain briefly the selection of FHP motors.
66. What is the importance of name plate details of an AC motor. Give one
67. example for single phase and three phase AC motor.
68. State the necessity of starters for three phase AC motors and list the types and
69. applications.
70. List out the various industrial applications of DC motors.
71. List out the selection criteria of DC motors for various industrial applications.
72. List out the various industrial applications of AC motors.
73. List out the selection criteria of AC motors for various industrial applications.
74. Explain the need of mechanical enclosures for motors and state the applications.
75. List the different types of mechanical enclosures for motors with their applications.

Unit 5 - Protective Devices, UPS and Estimation

Cognitive Level: UNDERSTAND

76. Sate the meanings of over voltage, under voltage and normal voltage w.r.t AC.
77. Sate the meanings of over loading, over and short circuit currents.
78. What is fuse? List the types.
79. List the applications of re-wire able, cartridge, and HRC fuses.
80. List out the different types of switches with their symbols.
81. State the sequence of steps for shock treatment.
82. State the definitions of Cell and Battery. List the types of Batteries.
83. What are SMF batteries? List the advantages over conventional batteries.
84. What are the functions of UPS.

Cognitive Level: APPLICATION

85. Explain the necessity of Protective devices. List the types.
86. Distinguish between MCB and ELCB.
87. Explain the necessity of electrical Earthing. List types of earthing.
88. Explain the necessity of earthing an electrical equipment..
89. State any five general electrical safety precautions.
90. Explain briefly electric shock treatment.
91. Explain the ratings of Battery.
92. Differentiate Primary and Secondary Batteries.
93. Mention the conditions for fully charged and discharged Lead Acid Battery.
94. Explain the selection of batteries.
95. What is an UPS and its rating? List the different types.
96. Explain the selection criteria of an Un-interrupted Power Supply.
97. Plan and estimate the cost of electrical wiring for one 3mX3m room having consisting of 2 tubelights,1 ceiling fan, 2 three pin socket .
98. Plan and estimate the cost of electrical wiring for One lathe for three phase wiring with MCBs, starters, Iron clad switches ,and HRC fuses

Unit 6 - Electronic Components and Applications

Cognitive Level: UNDERSTAND

99. What are semiconductors? List the properties.
100. What are semiconductors? List the types and applications.
101. What is a Diode. List the types and their applications.
102. With a neat diagram explain the working of half wave rectifier.
103. What is a transistor? Mention the types with their symbols.
104. Explain the operation of Zener diode as a Voltage Regulator.
105. List the applications of Timers.
106. What is a Relay. List the types.
107. List the applications of Relays.
108. What is an IC? State the advantages of Integrated Circuits over discrete
109. components.

Cognitive Level: APPLICATION

110. Distinguish between Intrinsic and Extrinsic semiconductors.
111. Explain P and N type semiconductors.
112. Explain the operation of PN junction Diode.
113. Explain the operation of Diode in no bias, forward and reverse bias conditions.
114. Explain the VI characteristics of Diode.
115. Explain with a neat sketch and waveforms the working of a full wave bridge
116. rectifier.
117. Explain the operation of NPN Transistor.
118. What is a BJT. List the applications of BJTs.
119. Explain with a neat circuit diagram the operation of Transistor as a Switch.
120. What is a SCR or Thyristor. Write the symbol. Also, list the industrial
121. applications of SCRs.
122. Explain with a simple diagram he operation of SCR.
123. What is a Timer. List the types.
124. Draw the logic symbol, write the truth table and Boolean expression for the
    following logic gates;
    a) NOT
    b) OR
    c) AND
    d) NAND
    e) NOR
    f) EX-OR.

	Course Title: **ENGINEERING GRAPHICS-II**	Course Code:**15ME21D**
	Credits (L:T:P) : **0:2:4**	Core/ Elective: **Core**
	Type of course: **Lectures & Practice**	Total Contact Hours: **78**
CIE- 25 Marks		SEE- 100 Marks

(Common to all Mechanical /AE/MTT/CH Programme)

Prerequisites: ENGINEERING GRAPHICS-I

COURSE OBJECTIVES

1. The course is aimed at developing Basic Graphic skills
2. Develop Skills In Preparation Of Engineering Drawings, their Reading And Interpretation

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked units**	**Linked PO**	**Teaching Hrs**
CO1	Draw simple solids and sectional views of simple solids	*U/A*	1,2	1,2,3,9,10	**39**
CO2	Draw the development of simple utility articles	*U/A*	3	1,2,3,9,10	**15**
CO3	Draw Orthographic views of given machine component.	*U/A*	4	1,2,3,9,10	**12**
CO4	Develop the ability to draw the isometric view from the orthographic views of a given machine component.	*U/A*	5	1,2,3,9,10	**12**
				Total sessions	**78**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
ENGINEERING GRAPHICS-II	**3**	**3**	**3**	-	-	-	-	-	**3**	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.
METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
IF < 5% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS CONSIDERED NOT-ADDRESSED.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks weightage	weightage (%)
			R	U	A		
1	**Projection of solids**	21	--	10	30	40	27
2	**Section of solids**	18	--	--	30	30	21
3	**Development of Surfaces**	15	--	--	30	30	21
4	**Conversion of pictorial views into Orthographic views**	12	---	---	15	15	10
5	**Isometric projection**	12	---	---	30	30	21
	Total	78		10	135	145	100

Legend: R; Remember, U: Understand A: Application

COURSECONTENT

UNIT:I	**PROJECTION OF SOLIDS**	**CONTACT HOURS:21 Hours**

Introduction-Positioning of solids –Solid lying with base on HP- Solids lying with base or axis inclined to HP- Solids lying with one of the lateral faces on HP- Solids lying with one of their lateral edges on HP-Cylinder lying with its axis or base inclined to HP- Cone lying with its axis or base inclined to HP -Solid lying with their axis inclined to both HP and VP.

UNIT:II	**SECTION OF SOLIDS**	**CONTACT HOURS: 18 Hours**

Introduction to Sectioning –Representation of section planes-Section lines and hatching-Types of Section planes-True shape of a section-Sectioning of solid like cube, prism, pyramid, cylinder and cone -Obtaining true shape of section.

UNIT:III	**DEVELOPMENT OF SURFACES**	**CONTACT HOURS: 15 Hours**

Introduction to Development of surfaces-Development of lateral surfaces of cube, prism, cylinder, pyramid, and cone-Development of lateral surfaces of truncated prism, cylinder, pyramid, and cone-Development of lateral surfaces of Tray, Funnel.

UNIT:IV	CONVERSION OF PICTORIAL VIEWS INTO ORTHOGRAPHIC VIEWS	CONTACT HOURS: 12 Hours

Introduction –Guidelines for conversion of pictorial views into orthographic views-Illustrative problems.

UNIT:V	ISOMETRIC PROJECTIONS	CONTACT HOURS: 12 Hours

Principles of isometric projection – isometric scale – isometric views of simple solids – cube – prisms, pyramids, cylinder and cone - Conversion of orthographic views into isometric View -Drawing of Isometric views of machine parts.

TOTAL: 78 Hours

TEXT BOOK

1.K.R.Gopalakrishna*"Fundamentalsof Drawing"* Subhas Publications, 2010.
2.K.R.Gopalakrishna*"Engineering Drawing" (Vol. I & II),*Subhas Publications, 2014.

REFERENCES

1. R.K. Dhawan, *"A text book of Engineering Drawing",*S.ChandPublishers, Delhi,2010.
2.G.S. Phull and H.S.Sandhu, *"Engineering Graphics",* Wiley Publications, 2014.
3. K.Venugopal and V.Prabhu Raja, *"Engineering Graphics",* New Age International Private Limited, 2008.
4. M.B.Shah and B.C.Rana, *"Engineering Drawing",* Pearson Education, 2005.
5. BasantAgarwal and Agarwal.C.M.,*"Engineering Drawing",* Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment method	CIE	IA	Students	Graded Exercises	25	Drawing Sheets	1,2,3,4,
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 ,4 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,Effectiveness of Delivery of instructions & Assessment Methods

NOTE:THIS SUBJECT SHOULD THOUGHT IN A BATCH OF 15 TO 20 STUDENTS,TEACHER ALOTTED PER BATCH HAS TO MONITER, EVALUATE OR ASSESS THE STUDENTS.

Diploma in Mechanical Engineering
2nd semester
Course title: **Engineering Graphics-II (Conventional)**

Time: 4 Hrs.   **Max. marks: 100**

Note: Part –A is compulsory. Answer ANY TWO full questions from Part-B,C& D

Part –A

1.A hexagonal pyramid of 25 mm side of base and height 55 mm rests with one of its   10
triangular faces on HP and the axis parallel to VP. Draw its top and front views.

Part –B

2.Draw the projection of a pentagonal prism of base side 25mm and axis length 45mm resting on a corner such that the two base edges passing through it make equal inclination with HP and   its base inclined at 60° to HP and the axis appears to be inclined at 30° to VP in the top view.--15

3.A cone of base diameter 50mm and altitude 70mm is lying with one of its generators on HP and the axis appears to be inclined to VP at an angle of 40 degree in the top view. Draw its top and front views.
-- 15

4. A cylinder 60 mm diameter and 80 mm long stands with its base on HP. A section plane
Perpendicular to VP and inclined at 60° to HP cuts the axis at a point 28 mm from its top end.
Draw the sectional top view and true shape of the section.   --15

Part –C

5.A hexagonal pyramid of base side 30 mm and axis 65 mm rests on its base on the HP with
one of its base edges perpendicular to VP. A cutting plane perpendicular to VP and inclined
at 45° to HP meeting the axis 25 mm from the vertex. Draw the sectional top view and true shape of the section.
                                                         -- 15
.
6.A vertical cone 40 mm diameter of base and height 50 mm is cut by a section plane perpendicular to VP and inclined at 30° to HP so as to bisect the axis of the cone. Draw the
development of the lateral surface of the truncated cone.   --15

7.A square pyramid of 30mm edges of base and height 50mm rests on its base on HP with one of its base edges parallel to VP. It is cut by a sectional plane perpendicular to VP and inclined at45° to HP bisecting the axis. Draw the development of the truncated pyramid.--15

Part –D

8.Draw the three principal views of the component as shown in the figure.   --15
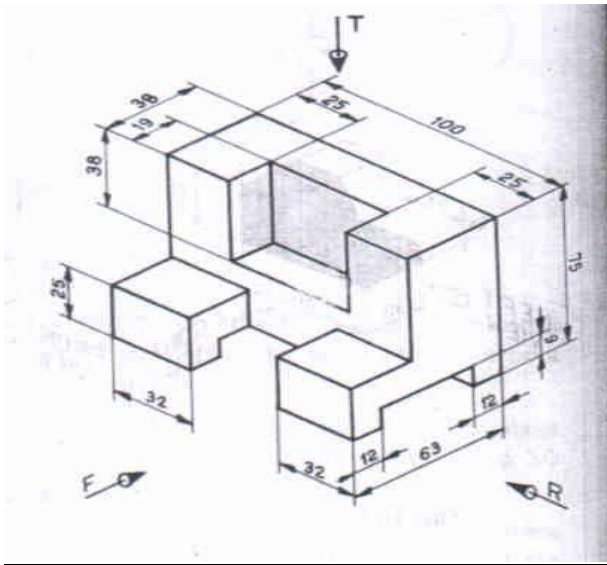
9. Draw the isometric view of the machine component whose orthographic views are given below:

-- 15

All dimensions in mm
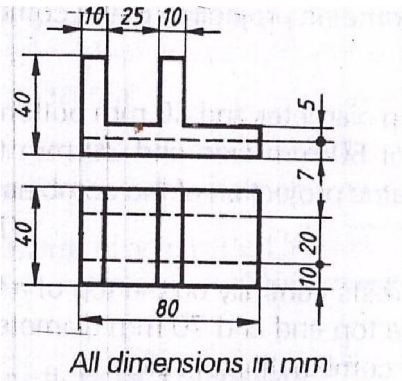
10. Draw the isometric projection of a frustum of a cone of 40 mm top diameter, 80 mm bottom diameter and 60 mm height.   --15

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CO 1:DRAW SIMPLE SOLIDS

LEVEL:UNDERSTANDING

(10Marks Questions)

1. A triangular prism of base edge 40mm and height 65mm rests with one of its base edges on HP so that the axis of the prim is inclined at 30° with HP. Draw the projections when the axis of the prism is parallel to VP.
2. A square prism of base edge 40mm and height 65mm rests with one of its base edges on HP. The axis of the prism is inclined at 45° to HP and parallel to VP. Draw the top and the front views of the prism.
3. A pentagonal prism of base 35mm and height 60mm has its base edge on HP. Draw the projections if the base of the prism is inclined at 30° to the HP. The axis of the prism is parallel to the VP.
4. A Hexagonal prism of base 35mm and height 60mm is resting with its base edge on HP so that the axis is inclined at 45° and parallel to VP. Draw its projections.
5. The axis of the square prism of base edge 40mm and height 60mm is inclined at 30° to HP and parallel to the VP. Draw the projections when the prism is placed with one of its corners on HP. The two adjacent base edges containing this corner are equally inclined to HP.
6. A pentagonal prism of base 35mm and axis height 60mm is resting with one of its base corners on HP such that the axis is inclined at 30° to the HP. Draw the projections when the axis of the prism is parallel to VP.
7. A triangular pyramid of base edge 40mm and height 65mm is resting with one of its base edges on HP so that the axis of the pyramid is parallel to VP and inclined at 45° to HP. Draw the projections.
8. Draw the projections of a hexagonal pyramid resting with one of its base edges on HP such that the axis of the pyramid is inclined at 30° to HP. The hexagonal pyramid has its base edges as 35mm and axis height as 60mm.
9. A pentagonal pyramid of base edge 35mm and axis height 65mm rests with one of its base corners on HP so that the axis of the pyramid is inclined at 45° to the HP. Draw the projections if the axis of the pyramid is parallel to the VP.
10. A square pyramid of base 40mm and axis height 65mm rests with its triangular lateral surfaces on HP so that the axis of the pyramid is parallel to the VP. Draw the projections.
11. A hexagonal pyramid is resting with one of its triangular lateral surfaces on HP. Draw the projections if its base edges are 40mm and the axis height is 65mm.
12. A pentagonal pyramid of base edge 40mm and axis 65mm rests with its slant edge on HP so that its axis is parallel to the VP. Draw the projections.
13. A cylinder of 40mm diameter and axis height 65mm rests with its points of the circumference on HP so that the axis is inclined at 45° to the HP and parallel to the VP. Draw the projections.
14. A cone of 40mm diameter and axis height 65mm is resting with points of the circumference on HP. Draw the projections if the axis of the cone is inclined at 30° with HP and parallel to VP.

15. A cone of 45mm diameter and axis height 60mm is resting with its end slant generator on HP so that the axis of the cone is parallel to VP. Draw the projections of the cone.

16. **A pentagonal prism of 30mm side of base and height 60mm rests with one of its edges of the base on HP such that the axis is inclined at 30° to HP and parallel to VP. Draw the top and front views.**

17. A hexagonal pyramid of 25mm side of base and height 60mm rests with one of its base edges on HP such that the base is inclined at 45° to HP, and the axis parallel to VP. Draw the top and front views.

18. A hexagonal pyramid of 25mm edge of base and height 60mm rests with one of its corners of the base on HP such that the base is inclined at 30° to it and the axis parallel to VP. The two of the base edges containing the corner on which the pyramid rests make equal inclinations with HP. Draw the projections.

19. A pentagonal prim of 30mm side of base and height 55mm rests with one of its rectangular faces on HP and the axis parallel to VP. Draw its projections.

20. Draw the top and front views of a triangular prism of 35mm side of triangular faces and height 60mm rest with one of its longer edges on HP such that the axis is parallel to VP and the rectangular face opposite to the slant edge on which the prism rests in perpendicular to VP.

21. Draw the top and front views of a pentagonal pyramid of side of base 30mm and height 60mm rests with one of its slant edges on HP and the axis parallel to VP.

LEVEL:APPLICATION   (15 MARKS)

22. A cube of 40mm edge rests on HP so that this edge is inclined at 45° to VP. One of the lateral surface is inclined at 45° to HP. Draw the top and front views of the cube.

23. An equilateral triangular prism of base side 25mm and 50mm long rests with one of the its shorter edges on HP so that the rectangular face containing the edge on which the prism rests inclined at 30° to the HP. The edge on which the prism rests is inclined at 60° to the VP. Draw its projections.

24. A pentagonal prism of base edge 30mm and 60mm long has its base edge on HP. The axis of the prism is inclined at 30° to the HP and appears to be inclined at 45° to the VP. Draw the top view and the front views of the prism.

25. A hexagonal prism of 30mm base edge and axis 60mm long is placed with one of its base edges on HP so that the axis is inclined at 30° to HP and the **axis appears to be inclined at 45° to VP.** Draw the projections when the base of the prism is nearer to the observer.

26. A square prism of base edge 40mm and 60mm long rests with one of its corners of the base so that the longer edge passing through this corner is inclined at 40° to the HP. Draw the projections if the axis appears to be inclined at 45° to the VP in the top view.

27. A square pyramid of base edge 40mm and 60mm long has one of its shorter edges on HP. The axis of the pyramid is inclined at 30° to the HP and appears to be inclined at 45° to the VP. Draw the projections if the apex is near to the observer.

28. A cylinder of 40mm diameter and axis height 60mm is resting with its ends of the base diameter on HP. The axis of the cylinder is inclined at 30° to the HP and appears to be inclined at 45° to VP. Draw the projections.

29. A cone of base diameter 50mm and axis 80mm lies on HP with its axis inclined at 45° to HP and appears to be inclined at 30° to the VP in the top view. Draw the top and front views of the cone.

30. A right cylinder is 50mm diameter of base and height 70mm. It rests such that the axis is **inclined at 30° and 45° to HP and VP respectively**. Draw the top and front views.

31. A cone of base 80mm diameter and height 100mm is lying with one of its generators on HP and its axis appears to be inclined at 40° to VP in the top view. Draw its front and top views.

32. **Draw the projections of a pentagonal prism 20mm side of base and axis 40mm long resting on a corner such that two base edges passing through it make equal inclinations with HP and its base is inclined at 60° to HP, and the axis appears to be inclined at 30° to VP in the top view.**

33. Draw the top and front views of a rectangular pyramid of sides of base 20x25mm and height 35mm when it lies with one of its triangular faces containing the longer edge of the base on HP. This longer edge of the base containing the triangular face lying on HP is inclined at 60° to VP in the top view with the apex of the pyramid nearer to VP.

34. A pentagonal pyramid 20mm side of base of 35mm altitude rests with one of its corners on HP such that the two base edges passing through the corner on which it rests make equal inclinations with HP. The axis is inclined at 45° to VP and 30° to HP. Draw the top and front views of the pyramid.

35. A hexagonal pyramid, base 30mm side and axis 60mm long has one of its slant edges on HP such that two of its triangular faces containing the slant edge on which it rests are equally inclined to HP. The top view of the axis appears to be inclined at 45° to VP. Draw its projections when its base is nearer to the observer than its apex.

36. A cone of base 60mm diameter and axis 80mm long rests on **HP with its axis inclined 45° an 30° with HP and VP respectively**. Draw the top and front views of the cone.

37. Draw the top and front views of a right cylinder of base 45mm diameter and 60mm long when it lies on HP, such that its axis is inclined at 30° to HP and the axis appears to be perpendicular to the VP in the top view.

CO 1:DRAW SECTIONAL VIEWS OF SIMPLE SOLIDS

LEVEL:APPLICATION

(15 Marks Questions)

1. A cube of 30 mm edges rests with a square face of HP such that one of its vertical square faces is inclined at 30° to VP. A section plane perpendicular to VP and inclined at 60° to HP passes through a point on the axis 5 mm below its top end. Draw its sectional top view, front view and true shape of the section.

2. A square prism of 45 mm side ofbase, height 90 mm rests with its base on HP such that one of the rectangular faces is inclined at 30° to VP. A section plane perpendicular to VP and inclined at 60° to HP passes through a point on the axis at a height of 70 mm. Draw the front view, sectional top view and true shape of the section.

3. A square prism side of base 40 mm and axis 60 mm long rests with its base on HP such that one of its rectangular faces is inclined at 30° to VP. A section plane perpendicular to HP and inclined at 60° to VP passes through the prism at a distance of 10 mm from the axis. Draw the top view, sectional front view and true shape of the section.

4. A pentagonal pyramid of 20 mm edge of base and 40 mm high stands vertically with its base on HP and an edge of the base perpendicular to VP. A section plane perpendicular to HP and inclined at 30° to VP cuts the pyramid such that it passes through the pyramid at a shortest distance of 5 mm from its axis and in front of it. Draw the top view, sectional front view and true shape of the section.

5. A triangular pyramid of 30 mm side of base and axis 45 mm long is placed with its base on HP such that an edge of the base is parallel to VP and nearer to it. A cutting plane inclined at 60° to HP and perpendicular to VP bisects the axis of the pyramid. Draw the front view, sectional top view and true shape of the section.

6. Draw the front view, sectional top view and true shape of the section of a hexagonal pyramid, 20 mm side of the base and 50 mm high resting with its base HP such that an edge of the base is parallel to VP. The pyramid is cut by a section plane perpendicular to VP and inclined at 30° to HP. Section plane bisects the axis of the pyramid.

7. A cylinder 60 mm diameter and 80 mm long stands with its circular base on HP. A section plane perpendicular to VP and inclined at 60° to HP cuts the axis at a point 28 mm from its top end. Draw front view, sectional top view and true shape of the section.

8. A cylinder of base diameter 45 mm and height rests on its base on HP. It is cut by a section plane perpendicular to VP and inclined at 30° to HP and meets the axis at a distance of 30 mm from the base. Draw the front view, sectional top view and true shape of the section.

9. A cone, diameter of base 60 mm and axis 70 mm long, is resting on its base on HP. It is cut by a section plane perpendicular to VP, inclined at 45° to HP and passing through a point on the axis 40 mm above the base. Draw the front view, sectional top view and true shape of the section.

10. A cone, base 60 mm diameter and axis 70 mm long, stands vertically with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 45° to HP and is bisecting the axis. Draw the front view, sectional top view and true shape of the section. Name the true shape of the section.

11. A cone, base 60 mm diameter and axis 70 mm long, stands vertically with its base on HP. It is cut by a section plane whose vertical trace is perpendicular to VP and parallel to one of the end generators of the cone and passes at a distance of 15 mm from it. Draw the front view, sectional top view and true shape of the section. Name the true shape of the section.

12. A cone, base 60 mm diameter and axis 70 mm, stands vertically with its base on HP. It is cut by a section plane perpendicular to VP and inclined at 75° to HP, so as to cut the axis of the cone at a point 20 mm above the base. Draw the front view, sectional top view and true shape of the section. Name the true shape of the section.

13. A cone, base 60 mm diameter and axis 70 mm, stands vertically with its base on HP. The section plane perpendicular to HP and parallel to VP cuts the cone at a distance of 10 mm from the axis. The section

plane is in front of the axis of the cone. Draw top view, sectional front view and true shape of the section. Name the true shape of the section.

14. A square pyramid of base side 30 mm and axis length 60 mm is resting on HP on its base with one side of base inclined at 30° to VP. It is cut by a section plane inclined at 45° to HP and perpendicular to VP and passes through the axis at a distance 52 mm from the apex. Draw its front view, sectional top view and true shape of the section.

15. A pentagonal pyramid of base side 40 mm and axis length 75 mm is resting on HP on its base with one of its base side parallel to VP. It is cut by a section plane inclined at 35° to HP and perpendicular to VP and is bisecting the axis. Draw its front view, sectional top view and true shape of the section.

16. A pentagonal pyramid of base side 20 mm and altitude55 mm rests on its base on HP with one of the base edges being perpendicular to VP. It is cut by a section plane perpendicular to VP and inclined at 50° to the HP. The section plane meets the axis at 15 mm above the base. Draw its front view, sectional top view and true shape of the section.

17. A hexagonal pyramid of base side 25 mm and axis 50 mm long rests with its base on HP and an edge of its base is perpendicular to VP. It is cut by a section plane perpendicular to VP, inclined at 30° to HP and passing through a point on the axis 20 mm below the apex. Draw its front view, sectional top view and true shape of the section.

18. A hexagonal pyramid of base side 30 mm and altitude 70 mm rests with its base on HP and with a side of base is parallel to VP. It is cut by a section plane perpendicular to VP, inclined at 35° to HP and is bisecting the axis. Draw its front view, sectional top view and true shape of the section.

19. A hexagonal pyramid of base side 25 mm and axis 50 mm long rests with its base on HP such that one of the edges of its base is perpendicular to VP. It is cut by a section plane perpendicular to HP and inclined at45° to VP and passing through the pyramid at a distance of 10 mm from the axis. Draw its top view, sectional front view and true shape of the section.

20. A square prism side of base 40 mm and axis 60 mm long rests with its base on HP such that one of its rectangular faces is incline at 30° to VP. A section plane perpendicular to HP and inclined at 60° to VP passes through the prism at a distance of 10 mm from the axis. Draw its top view, sectional front view and true shape of the section.

21. A cube of 40mm edge rests on HP so that this edge is inclined at 45° to VP. One of the lateral surface is inclined at 45° to HP. Draw the top and front views of the cube.

22. An equilateral triangular prism of base side 25mm and 50mm long rests with one of the its shorter edges on HP so that the rectangular face containing the edge on which the prism rests inclined at 30° to the HP. The edge on which the prism rests is inclined at 60° to the VP. Draw its projections.

23. A pentagonal prism of base edge 30mm and 60mm long has its base edge on HP. The axis of the prism is inclined at 30° to the HP and appears to be inclined at 45° to the VP. Draw the top view and the front views of the prism.

24. A hexagonal prism of 30mm base edge and axis 60mm long is placed with one of its base edges on HP so that the axis is inclined at 30° to HP and the **axis appears to be inclined at 45° to VP.** Draw the projections when the base of the prism is nearer to the observer.

25. A square prism of base edge 40mm and 60mm long rests with one of its corners of the base so that the longer edge passing through this corner is inclined at 40° to the HP. Draw the projections if the axis appears to be inclined at 45° to the VP in the top view.

26. A square pyramid of base edge 40mm and 60mm long has one of its shorter edges on HP. The axis of the pyramid is inclined at 30° to the HP and appears to be inclined at 45° to the VP. Draw the projections if the apex is near to the observer.

27. A cylinder of 40mm diameter and axis height 60mm is resting with its ends of the base diameter on HP. The axis of the cylinder is inclined at 30° to the HP and appears to be inclined at 45° to VP. Draw the projections.

28. A cone of base diameter 50mm and axis 80mm lies on HP with its axis inclined at 45° to HP and appears to be inclined at 30° to the VP in the top view. Draw the top and front views of the cone.

29. A right cylinder is 50mm diameter of base and height 70mm. It rests such that the axis is **inclined at 30° and 45° to HP and VP respectively**. Draw the top and front views.

30. A cone of base 80mm diameter and height 100mm is lying with one of its generators on HP and its axis appears to be inclined at 40° to VP in the top view. Draw its front and top views.

31. Draw the projections of a pentagonal prism 20mm side of base and axis 40mm long resting on a corner such that two base edges passing through it make equal inclinations with HP and its base is inclined at 60° to HP, and the axis appears to be inclined at 30° to VP in the top view.

32. Draw the top and front views of a rectangular pyramid of sides of base 20x25mm and height 35mm when it lies with one of its triangular faces containing the longer edge of the base on HP. This longer edge of the base containing the triangular face lying on HP is inclined at 60° to VP in the top view with the apex of the pyramid nearer to VP.

33. A pentagonal pyramid 20mm side of base of 35mm altitude rests with one of its corners on HP such that the two base edges passing through the corner on which it rests make equal inclinations with HP. The axis is inclined at 45° to VP and 30° to HP. Draw the top and front views of the pyramid.

34. A hexagonal pyramid, base 30mm side and axis 60mm long has one of its slant edges on HP such that two of its triangular faces containing the slant edge on which it rests are equally inclined to HP. The top view of the axis appears to be inclined at 45° to VP. Draw its projections when its base is nearer to the observer than its apex.

35. A cone of base 60mm diameter and axis 80mm long rests on HP with its axis inclined 45° and 30° with HP and VP respectively. Draw the top and front views of the cone.

36. Draw the top and front views of a right cylinder of base 45mm diameter and 60mm long when it lies on HP, such that its axis is inclined at 30° to HP and the axis appears to be perpendicular to the VP in the top view.

LEVEL:APPLICATION

(15 Marks Questions)

1. A vertical square prism, side of the base 30mm and altitude 60 mm rests with its base on HP such that one of its rectangular faces makes an angle of 30° to VP. The prism is cut by a section plane perpendicular to VP and inclined at 60° to HP. The cutting plane bisects the axis of the prism. Develop the lower portion of the lateral surfaces of the prism.

2. A pentagonal prism 20 mm side of the base and height 55 mm stands vertically such that one of its rectangular faces is parallel to VP and nearer to it. Prism is cut by a cutting plane which is perpendicular to VP, inclined at 60° to HP and passes through one of the extreme corners of the top face of the prism. Develop the lower portion of the lateral faces of the prism so as to produce a one-piece development.

3. A vertical cylinder of base diameter 80 mm and axis length 100 mm is cut by a section plane perpendicular to VP and inclined at 45° to HP. Vertical trace of the section plane passes through the top end of one of the extreme generators. Develop the lower portion of the lateral surface of the cylinder.

4. A square pyramid of 30 mm side of the base and height 50 mm rests with its base on HP with one of the edges of the base parallel to VP. It is cut by a section plane perpendicular to VP and inclined at 45° to HP and bisecting the axis. Draw the development of the truncated pyramid.

5. A vertical cone 40 mm diameter of base and height 50 mm is cut by a section plane perpendicular to VP and inclined at 30° to HP so as to bisect the axis of the cone. Draw the development of the lateral surface of the truncated cone.

6. A pentagonal pyramid of side of base 30 mm and axis length 60 mm is resting on its base on HP with an edge of the base perpendicular to VP. It is cut by a section plane perpendicular to VP and parallel to HP and meets the axis at a distance of 30 mm from the vertex. Draw the development of remaining portion of the pyramid.

7. Draw the development of lower portion of a hexagonal pyramid of side 30 mm and height 60 mm resting on HP such that two of its base edges are perpendicular to VP. It is cut by a section plane perpendicular to VP and inclined at 40° to HP.

8. The frustum of a square pyramid has the following dimensions:
   i)   Side of the bottom square = 50 mm
   ii)   Side of the top square = 25 mm
   iii)   Height of the frustum = 70 mm.
   Draw the development of lateral surface of the pyramid.

9. Develop the lateral surface of the funnel shown in the figure:

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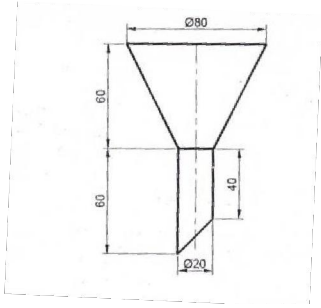
9. Draw the development of the tray shown in figure:
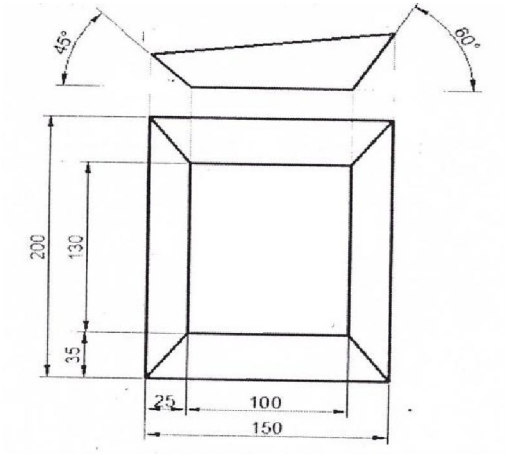
LEVEL:APPLICATION

(15 MARKS QUESTION)

.Draw the three principal views of the component as shown in the figure.

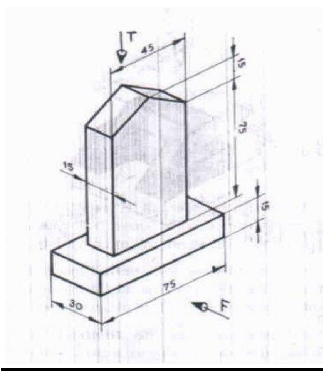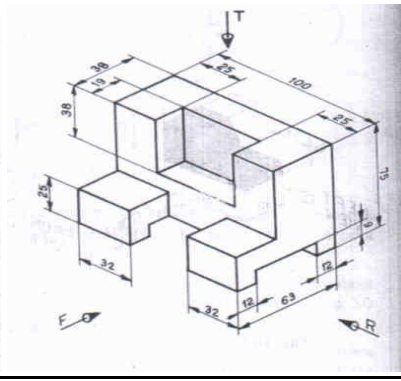**FIG-1**   **FIG -2**

FIG-3

FIG -4
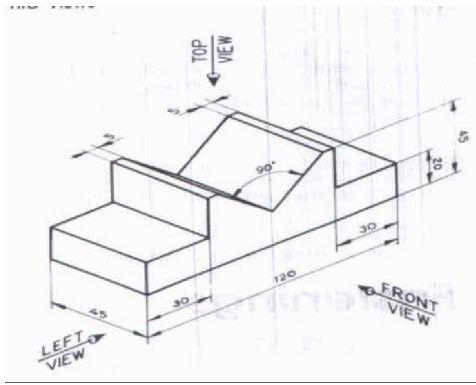
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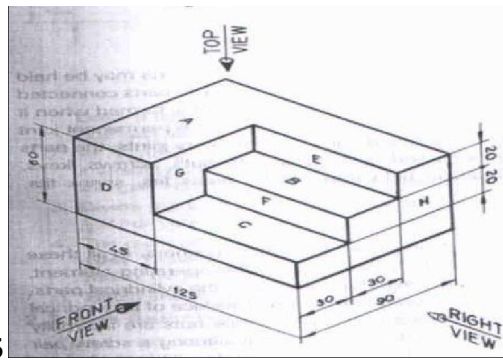
FIG-6
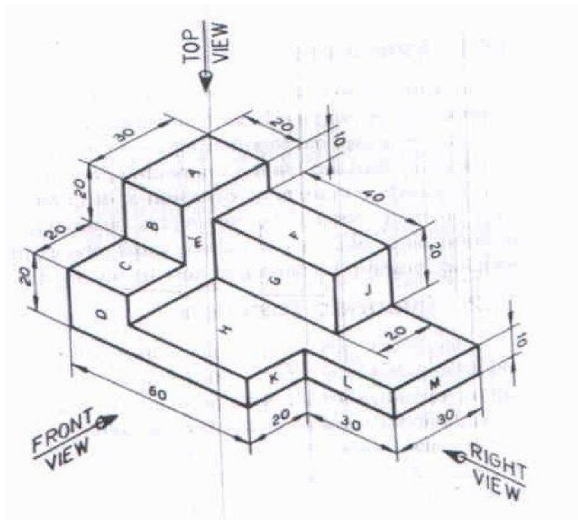
FIG-7
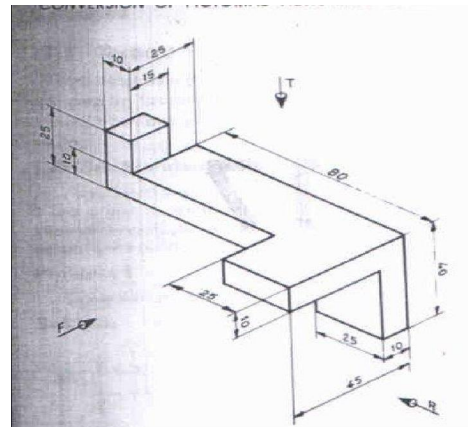
FIG-8
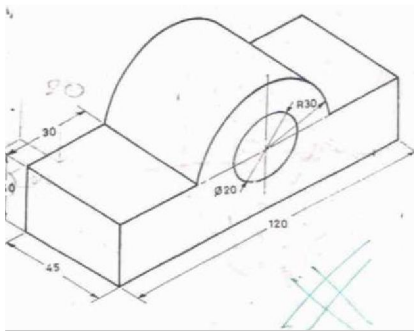
FIG-9
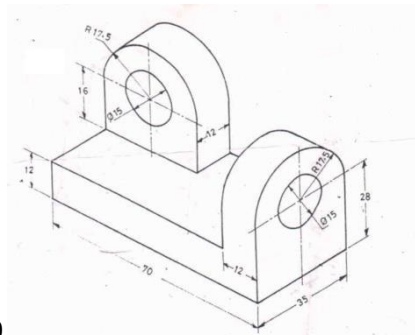
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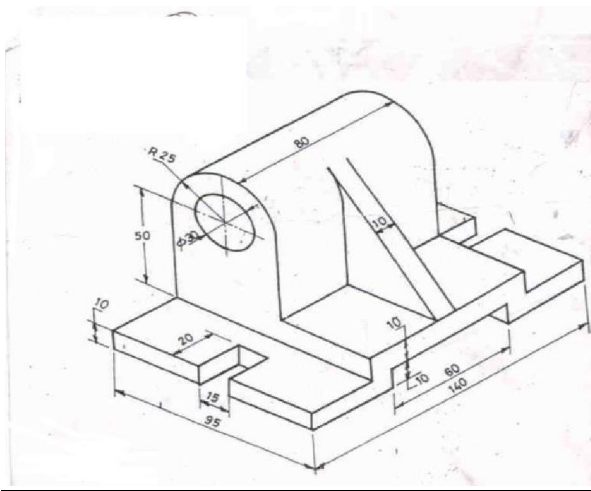
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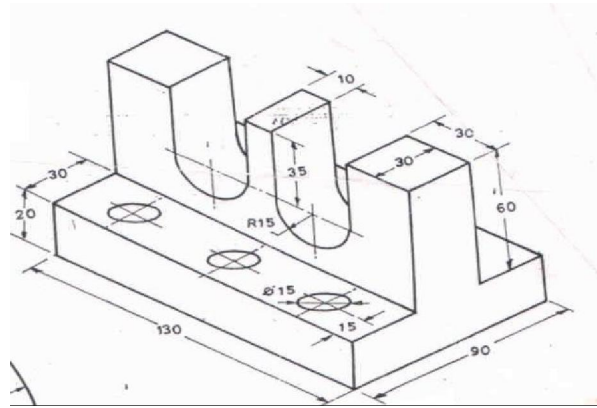
FIG-12
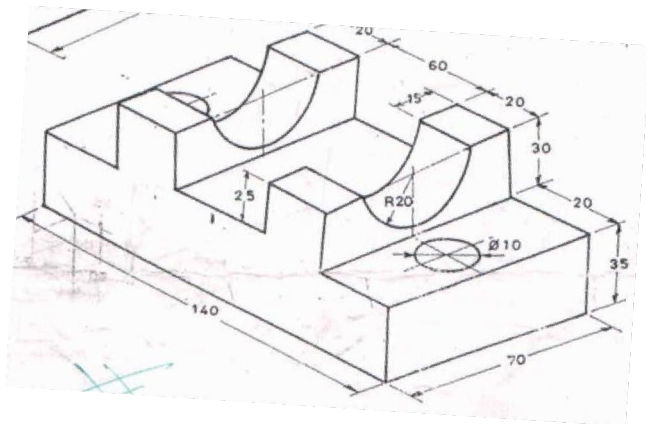
FIG-13
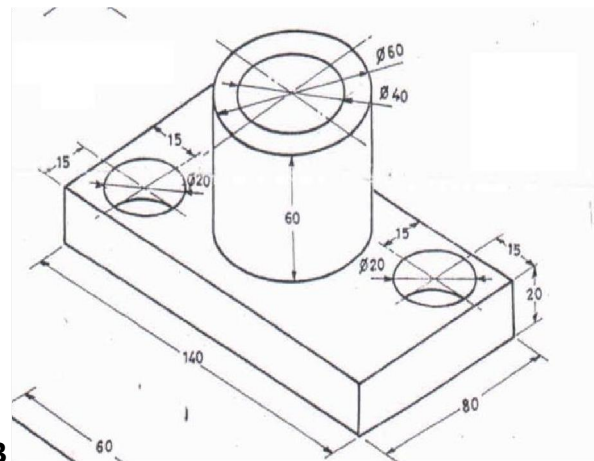
FIG-14
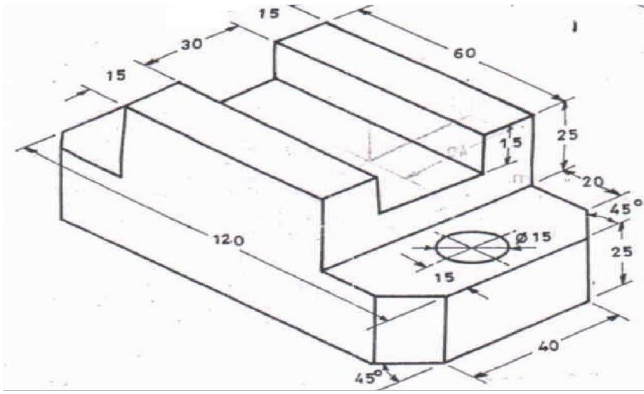
FIG-15

FIG-16

ALL DIMENSIONS ARE IN MM

LEVEL:APPLICATION

(15 MARKS QUESTION)
.Draw the isometric view of the machine component whose orthographic views are given below:
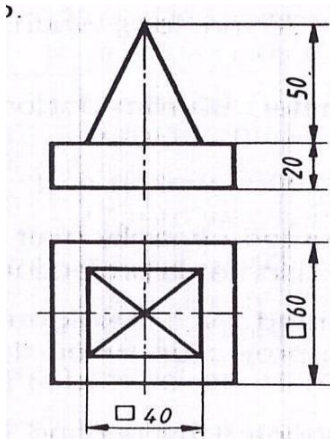
FIG-1   **FIG -2**   **FIG -3**
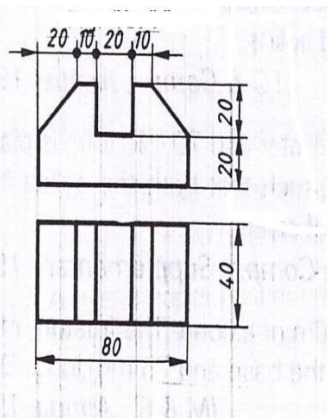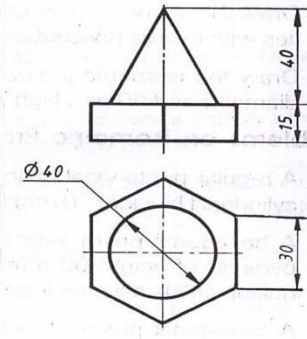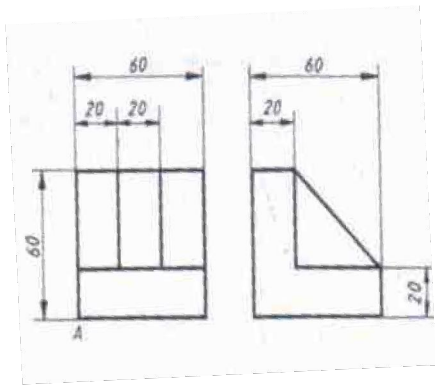
FIG-4   **FIG-5**   **FIG -6**
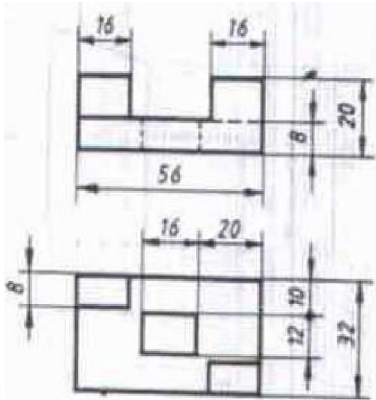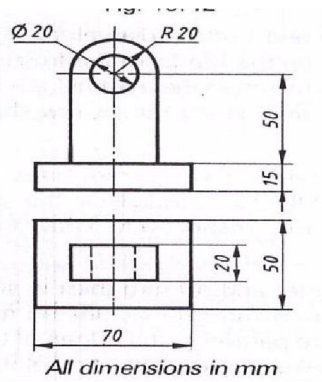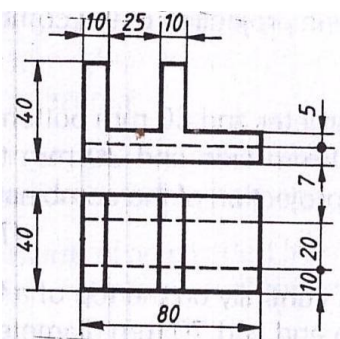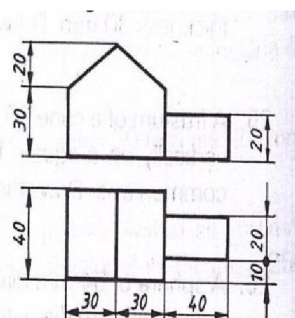
FIG-8   **FIG-9**
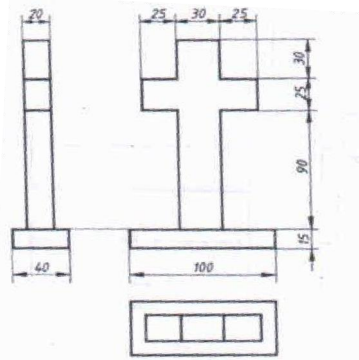
FIG-7
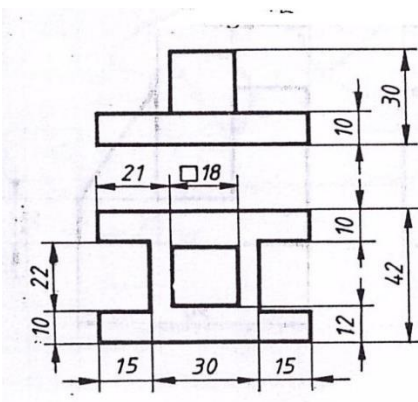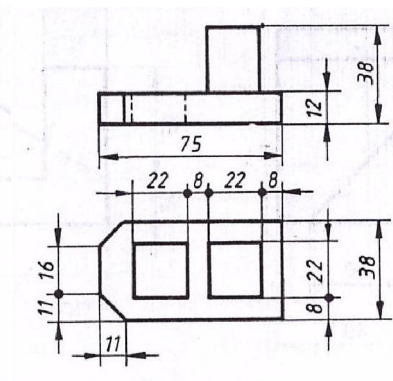
FIG-10FIG-11   **FIG -12**
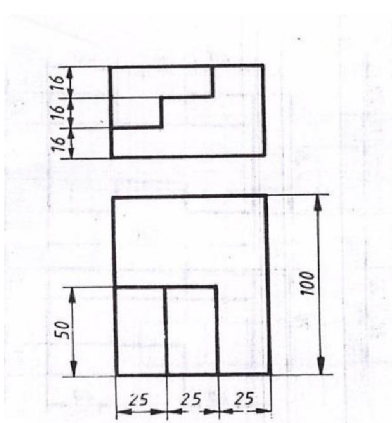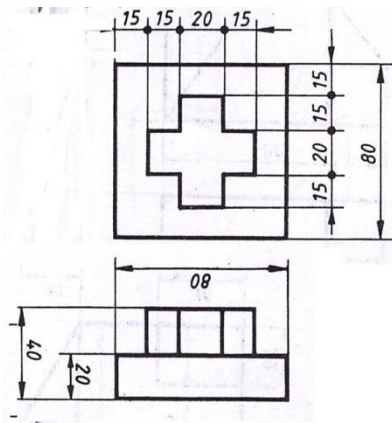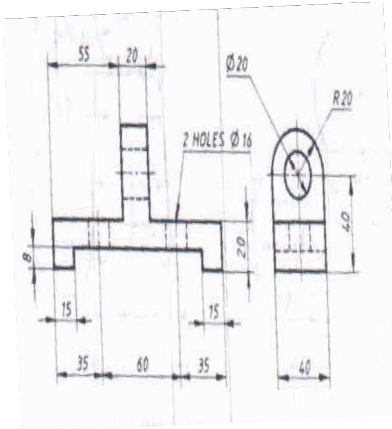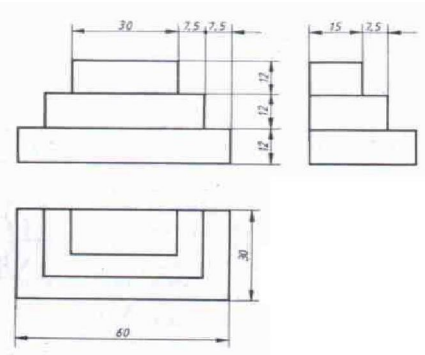
FIG-13   **FIG -14**   **FIG-15**

FIG-16FIG-17   **FIG-18**

FIG-19   **FIG-20**

21. Draw the isometric view of a frustum of a cone of 40 mm top diameter, 80 mm bottom diameter and 60 mm height.
22. A cube of side 30 mm rests centrally on the top of another cube of side 60 mm. Draw the isometric view of the solid.
23. A square pyramid of base edge 50 mm and height 80 mm rests on the top of the cube of side 100 mm. Two sides of the base of the pyramid are parallel to the top edges of the cube. Draw the isometric view of the solid.
24. A cylindrical block of 40 mm diameter and length 50 mm is resting vertically on the centre of the cube of 70 mm side. Draw the isometric view of the combination of solids.

25. A square pyramid of base side 22 mm and height 20 mm rests centrally on the top of a cylinder of base diameter 40 mm and height 30 mm.

Course Title	:**APPLIED SCIENCE LAB**	Course Code	: **15SC04P**
Semester	: **I / II**	Course Group	: **Core**
Teaching Scheme in Hrs (L:T:P)	: **0:2:4**	Credits	: **3** Credits
Type of course	: **Tutorial & Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**
Programme	: **Common to all Engineering Diploma Programmes**		

Prerequisite:

Applied Science theory in the current semester.

Course objective:

1. Learn to measure different dimensions of objects accurately using measuring instruments.
2. Enhance the vectorial concepts of concurrent forces.
3. Learn the concepts of properties of fluids.
4. Enhance the practical concept of resonance.

Experiments:

PART- A

1. Vernier Calipers:
   a) To determine the dimensions of given solid cylinder and hence calculate its volume.
   b) To determine the dimensions of given hollow cylinder and hence calculate its volume

Activity: To calculate the density of material of given solid/hollow cylinder knowing its volume and mass.

2. Screw Gauge:
   a) To determine the thickness of given metal and glass plate.
   b) To determine the diameter of given thin wire and hence to calculate its volume.
   c) To determine the diameter of given metallic sphere and hence to calculate its volume.

Activity: 1.To calculate volume of such half meter length wire.
   2. To calculate volume of such number (50 or 75 etc) of spheres.

3. Laws of concurrent forces:
   a) Verify the law of parallelogram of forces.

b) Verify the converse law of triangle of forces.

c) Verify Lami's theorem.

Activity: To determine the weight of given body using law of parallelogram of forces.

4. Moment bar:

To verify the conditions of equilibrium of coplanar parallel forces acting on a body.

Activity: To determine the weight of given body using moment bar.

PART-B

5. **Viscosity:**

a) To determine the co-efficient of viscosity of water by poiseuille's method(for a given radius of capillary tube)

Activity: To plot a graph of **ht** versus **V** and to find ht/**V** from slope.

6. **Sonometer**:

a) To determine the frequency of given tuning fork by comparison method.

b) To determine the frequency of given tuning fork by absolute method.

Activity: 1.Plot a graph of 'n' versus 'l' from the graph, find the frequency unknown Tuning fork

2.Plot a graph of $\sqrt{T}$ versus 'l' from the slope of graph find $\sqrt{T}$/l

3.To calculate linear density 'm' by knowing $\sqrt{T}$/l and 'n'

7. Resonance:

a). To determine the velocity of sound in air at room temperature by using resonance air column apparatus. (for single resonating length)

Activity:1. To calculate velocity of sound in air at 0^0 C.

2. To determine the unknown frequency of tuning fork.

8.**Surface Tension**:

a) To determine the Surface Tension of water by capillary rise method using

Travelling Microscope. (radius of capillary tube is given)

Activity: Calculate radius of the capillary tube by knowing the surface tension of the liquid and height of liquid column in capillary tube.

9. **Boyle's law**:

a) To verify Boyle's law using Boyle's law apparatus.

Activity:1.To plot a graph of pressure versus volume

2. To plot a graph of 1/pressure versus volume.

Course outcome:

On successful completion of the course, the student will be able to:

1. Measure the various dimensions of given objects using instruments.
2. Apply the vector concepts in engineering.
3. Apply the acquired knowledge of fluid dynamics in the field of engineering.
4. Apply the concepts of wave motion in engineering.

Mapping Course Outcomes with Program Outcomes:

CO –PO mapping

	Course Outcome	Experiment linked	PO Mapped	Cognitive Level	Lab Sessions
CO1	Measure the various dimensions of given objects using instruments.	**1,2**	**1,2,3,4,9**	**U/A**	**24**
CO2	Apply the vector concepts in engineering.	**3,4**	**1,2,9**	**U**	**16**
CO3	Apply the acquired knowledge of fluid dynamics in the field of engineering.	**5,8,9**	**1,2,3,9**	**A**	**24**
CO4	Apply the concepts of wave motion in engineering.	**6,7**	**1,2,3,9**	**U**	**14**
Total Hours of instruction					**78**

U-Understanding; A-Application;

Course outcomes –Program outcomes mapping strength

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Applied Science lab	3	3	3	1	-	-	-	-	3	-

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Assessment and Evaluation:

		What	To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	**CIE (Continuous Internal Evaluation)**	I A Tests	Students	Two IA tests for Practical (Average of Two Test marks will be computed)	10	Blue Books	1 to 4
		Record Writing		Record Writing (Average of Marks allotted for each expt.)	10	Record Book	1 to4
		Class room Assignments		Two Assignments based on CO's (Average marks of Two Assignments shall be rounded off to the next higher digit.)	05	Log of Activity	1 to 4
				TOTAL	25		
	SEE (Semester End Examination)	End Exam	Students	End of the Course	50	Answer Scripts at BTE	All the CO's
Indirect Assessment		Student Feedback on course	Students	Middle Of The Course	Feedback forms		1 to 2 delivery of the course
		End Of Course Survey		End Of The Course	Questionnaire		1 to 4 Effectiveness of delivery of instructions and assessment

Note: I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering and Understanding	35
2	Applying the knowledge acquired from the course	45
3	Analysis	05
4	Evaluation	05
5	Creating new knowledge	10

Reference Books:

1. Practical physics by pro. J.D.Belani and N.J.Belani. Published by Nebhandas Hiranand.
2. Practical physics by C.L. Arora. Published by S. Chand and company.
3. www.jac production.co.za

Model Question Bank:

Course: APPLIED SCIENCE LAB Course Code: 15SC04P

PART- A

1. Determine the dimensions of given Solid Cylinder using Vernier Caliper and hence calculate its volume.

2. Determine the dimensions of given Hollow Cylinder using Vernier Caliper and hence calculate its volume.

3. Determine the thickness of given metal and glass plate using screw gauge.

4. Determine the diameter of given thin wire using screw gauge and hence, to calculate its volume.

5. Determine the diameter of given metallic sphere using screw gauge and hence, calculate its volume.

6. Verify the law of parallelogram of forces.

7. Verify the converse of triangle law of forces.

8. Verify lami's theorem.

9. Verify the conditions of equilibrium of coplanar parallel forces using Moment bar.

PART- B

10. Determine the coefficient of viscosity of water by Poiseuille's method
    (For a given radius of capillary tube)

11. Determine the frequency of given tuning fork by comparison method using sonometer.

12. Determine the frequency of given tuning fork by absolute method using sonometer.

13. Determine the velocity of sound in air at room temperature by using resonance Air column Apparatus.

14. Determine the Surface Tension of water by capillary rise method.
    (For a given radius of capillary tube)

15. Verify Boyle's law using Boyle's law apparatus.

Scheme of Valuation for SEE (Semester End Examination)

Sl. no.	Performance	Max. Marks
1	Writing Observation, Tabular column, formula.	05x2=10
2	Conduction of experiment.	10x2=20
3	Calculation and Result.	05x2=10
4	Viva Voce.	10
	TOTAL	**50 Marks**

Note: The students will submit record books at the time of semester end exam.

Guidelines for Question Paper Setting

The question paper must be prepared by selecting **ONE** experiment from **PART – A** and **ONE** question from **PART – B**.

Specification of the Apparatus Required for Applied Science Lab

The following are the specification of the apparatus required for science lab, and number of apparatus required for the batch of 20 students.

Sl. No.	Name of the Apparatus	Specification	Required Number
1	Vernier calipers	With L.C 0.01cm having Metallic scale marked in cm, with objects :solid cylinder &hollow cylinder	10
2	Screw gauge	U-Shaped metallic frame with L.C 0.01mm with objects :glass plate, metal plate, thin wire and metallic sphere	10
3	Law of concurrent forces apparatus	Vertical Drawing Board fixed with pulleys. Weights 50g each with weight hangers set	10
4	Moment bar	Having two vertical metallic stands, two spring balances measuring up to 500 g .horizontal bar.	10
5	Surface tension apparatus	Traveling microscope, having L.C 0.005cm, both horizontal and vertical movement of telescope, eye piece with fine cross-wire, slow moving stand, beaker, with capillary tube	10
6	Viscosity apparatus	Aspiratory bottle, cork, capillary tube, stopwatch, measuring jar. With stand to keep Aspiratory bottle	10

		Wide bore glass tube mounted vertically in front of a scale graduated 0 to 60cm	
7	Boyle's law apparatus	Zero corresponds to the inside of the closed (top) end of the tube Air is confined in the tube by a coloured oil contained in a metal pressure chamber Pressure chamber is fitted with a Bourdon type gauge calibrated 0 to 3.5kg cm² (0 to 50 lb/in²) actual pressure A valve is fitted to the air inlet tube from the pump As the pressure in the oil chamber is increased, oil level and its actual (total) pressure are directly indicated Tube is made of extra strong glass and is securely covered with transparent plastic on the front Overall height of apparatus approx. 690mm	05
8	Sonometer	Wooden box fixed with meter scale, pulley, metallic string, weight with weight hanger (500g each)	10
9	Resonance air column apparatus	Consists of a resonance tube brass N.P. 100cms, reservoir brass N.P. 250ml & meter scale both sides millimeters, which are mounted on wooden polished board. The reservoir is caged in wooden block that has sliding facility.	10
10	Electronic balance	0.1g accuracy 500g capacity	01
11	Tuning fork set	Set of eight tuning forks of different frequency blue steel(Ragg's type)	06

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Government of Karnataka
Department of Technical Education, Bengaluru

Course: APPLIED SCIENCE LAB
Course code: 15SC04P

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1	Mr. R B Pawar	Principal	Govt. Polytechnic, Bijapur
2	Mr. K.Nazeer Ahmed	Selection Grade Lecturer	Govt. Polytechnic, Mulbagilu
3	Mr. Liyakhat Ali Khan	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
4	Dr. HanumanthaNayak	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
5	Ms. Bhagirathi B N	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru

`

Curriculum Review Committee

	Name	Designation	Institution
1	Mr. K.Nazeer Ahmed	Selection Grade Lecturer	Govt. Polytechnic, Mulbagilu
2	Mr. Liyakhat Ali Khan	Selection Grade Lecturer	S.J. Govt. Polytechnic, Bengaluru
3	Smt. Revathi	Selection Grade Lecturer	M.E.I. Polytechnic, Bengaluru

Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**	Course Code	: **15EE02P**
Semester	: **I /II/ III**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **0:2:4**(in Hours)	Credits	: **3 Credits**
Type of course	: **Tutorial + Practical**	Total Contact Hours	: **78**
CIE	: **25 Marks**	SEE	: **50 Marks**
Programme:	Mechanical (GL), Mechanical (Instr.), MTT, HPT, WSM, Mechatronics, Printing Technology, Textile Technology, Ceramics, Mining Engg., Metallurgical Engg**.**		

Pre-requisites	**:** Basic Electrical and Electronics Engineering theory in Diploma curriculum.
Course Objectives	**:** To provide practical knowledge about the DC &AC circuits, different wiring circuits, Battery, Relay, three phase AC motor, Panel board, semiconductor diodes, rectifiers and basic logic gates.

Course Outcomes:

On successful completion of the Course, the student will be able to:

1. Understand verification of Ohm's law experimentally.

2. Rig-up various wiring control circuits, panel board and meter board individually and test.

3. Rig-up circuits to measure power and energy in ac circuit.

4. Test and report the conditions and ratings of Battery.

5. Start and reverse the three phase induction motor.

6. Understand the operation of relay, diode circuits, rectifier circuits and logic gates

List of Graded Experiments:

1. Construct a suitable circuit to verify Ohm's law.
2. Rig up and test the wiring circuit to control a lamp and a three pin socket independently.
3. Rig up and test the wiring circuit to control two lamps independently.
4. Construct and test fluorescent lamp circuit.
5. Construct and test the staircase wiring circuit (control from 2 places).
6. Construct and test Meter board wiring using single phase Energymeter, MCB/ELCB, Kit-kat fuse and neutral link.
7. Build and test a circuit to measure power and power factor in a single phase ac circuit.
8. Construct a circuit to measure energy in KWh in a single phase ac circuit.
9. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/ Star-Delta/ Auto-Transformer starter.
10. Test and make a report of the fully charged and discharged conditions of a given Lead-acid battery.
11. Construct a circuit using a single Relay to turn ON a lamp connected to NC and to turn OFF another lamp connected to NO contacts of Relay.
12. Construct a circuit to obtain the forward bias characteristic of a Diode.
13. Construct and test Zener diode as a voltage regulator.
14. Build and test halfwave rectifier circuit.
15. Build and test full wave bridge rectifier circuit (without filter).
16. Construct a circuit to verify the truth tables of NOT,AND, OR, NOR and NAND gates.

17. Identify and draw the layout diagram for a simple PANEL BOARD/consisting of bus bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.

ReferenceBooks:

1. Experiments in Basic Electrical Engineering by S.K.Bhattacharya, New Age International Publications, 2007 Edition.
2. A Text book on Laboratory courses in Electrical Engg. by S.G. Tarnekar and P.K.Karbanda.

e-Resources:

1. http://www.scribd.com/doc/39578646/New-First-year-Electrical-lab-manual#scribd
2. http://mrcet.ac.in/newwebsite/pdfs/Labmanuals-13/ECE/LabManuals/ DC%20LAB%20%28180%29%20II-I.pdf

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	20
2	Understanding	20
3	Application/ Analysis	60
Total		**100**

Mapping Course Outcomes with Program Outcomes:
(Course Outcome linkage to Cognitive Level)

	Course Outcome	Experiment linked	PO Mapped	Cognitive Level	Lab Sessions
CO1	Understand verification of Ohm's law experimentally.	1	2, 3, 8, 9, 10	R/U/A	3
CO2	Rig-up various wiring control circuits, panel board and meter board individually and test.	2,3,4,5,6,17	2, 3, 8, 9, 10	U/A	18
CO3	Rig-up circuits to measure power and energy in ac circuit.	7,8	2, 3, 8, 9, 10	U/A	6
CO4	Test and report the conditions and ratings of Battery.	10	2, 3, 8, 9, 10	U/A	3
CO5	Start and reverse the three phase induction motor	9	2, 3, 8, 9, 10	U/A	3
CO6	Understand the operation of relay, diode circuits, rectifier circuits and logic gates	11,12,13, 14,15,16	2, 3, 8, 9, 10	U/A	18

U-Understanding; A-application/ Analysis; App-Application

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Basic Electrical and Electronics Lab	-	**3**	**3**	-	-	-	-	**3**	**3**	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.

IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3

IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2

IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1

IF < 5% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS CONSIDERED NOT-ADDRESSED.

Course Delivery:

The Course will be delivered through Tutorial, classroom interaction, group discussion, practical exercises and assignments.

Tutorial - 1Hr:

Staff-in-charge will
1. Explain the concept of experiment to be conducted.
2. Teach required selection of components/ meters/ equipment/ suitable wires for the experiment to be conducted.
3. Ask students to draw the circuit.
4. Give clear instructions about safety precautions to be followed while conducting experiment.

Conduction/ Execution- 2 Hr:

Student will rig up the circuit diagram and conduct experiment individually under the supervision of the staff-in-charge.

Course Assessment and Evaluation:

		What	To Whom	Frequency	Practical	Evidence Collected	Course Outcomes
Direct Assessment Method	**CIE (Continuous Internal Evaluation)**	I A Tests	Students	Two IA tests for Practical (Average marks of both the tests to be computed)	10	Blue Books	1 to 6
		Record Writing		Record Writing (Average of Marks allotted for each experiment.)	10	Lab Record	1 to 6
				Student activity	05	Log of Activity	1 to 6
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End of the Course	50	Answer Scripts	1 to 6
Indirect Assessment Method		Student Feedback on course	Students	Middle of The Course	Feed Back Forms		1 to 3
		End of Course Survey		End of The Course	Questionnaire		1 to 6

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

Suggested Student Activities:

Each Student has to prepare a self-hand written report of 3 pages or solved in a blue book considering any one of the following topics.

1. Mini-Projects: Like preparing extension box, switch box and wiring models,
2. Make a plan of building wiring for a lab/ room, etc.

3. Visit nearby Battery charging shop or show room and prepare a report of the visit.
4. Prepare a report of the conditions of batteries available in the Polytechnic.
5. For given voltage, current, Ah ratings of individual cell, and required voltage and current rating of battery, prepare a report of calculations for number of cells and their method of connections.
6. List out the different protective devices used in your laboratories or house with their ratings.
7. List out the different types of wiring systems used in your laboratories or house with their representation.

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimen sion	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks One activity on any one CO (course outcome) may be given to a group of FIVE students Grand Average/Total						14/4 =3.5 ≈4				

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Conversions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given– Industrial visit and report writing

Scheme of Valuation for SEE(Semester End Examination)

Sl. No.	Particulars	Marks
1.	Identification of meters/ equipments/ wires/ tools/ etc.	05
2.	Writing Circuit diagram and Procedure*	10
3.	Conduction	20
4.	Results	05
5.	Viva-voce	10
	Total	**50**
*Question Paper will have any ONE question from the list of experiments.		

Model Question Bank:

Course Title: **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**	Course Code: **15EE02P**

1. Construct a suitable circuit to verify Ohm's law. Also plot Graph.
2. Conduct an experiment to find the Resistance of a given unknown Resistor.
3. Rig up and test the wiring circuit to control a lamp and a three pin socket independently.
4. Rig up and test the wiring circuit to control two lamps independently.
5. Construct and test fluorescent lamp circuit.
6. Construct and test the staircase wiring circuit (control from 2 places).
7. Conduct an experiment to control a lamp from two places.
8. Construct and test Meter board wiring using single phase Energy meter, MCB/ELCB, Kit-kat fuse and neutral link.
9. Conduct a suitable experiment to test the Meter board wiring circuit.
10. Build and test a circuit to measure power and power factor in a single phase ac circuit.
11. Construct a circuit to measure energy in KWh in a single phase ac circuit.
12. Conduct an experiment to measure the single phase energy consumed in KWh for the given electrical load.
13. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL starter.
14. Construct a suitable circuit to start and reverse the direction of three phase induction motor using Star-Delta starter.
15. Construct a suitable circuit to start and reverse the direction of three phase induction motor using three phase auto-transformer starter.
16. Test and make a report of the fully charged and discharged conditions of a given Lead-acid battery.
17. Construct and test a circuit using a Relay to turn ON/ OFF a lamp connected to 230 Volts ac supply.
18. Conduct an experiment to control a lamp using a Relay.
19. Construct a circuit using a single Relay to turn ON a lamp connected to NC and to turn OFF another lamp connected to NO contacts of Relay.
20. Conduct an experiment to turn ON a lamp and turn OFF another lamp using a single Relay.
21. Construct a circuit to obtain the forward bias characteristic of a Diode.
22. Conduct an experiment to Plot the forward bias characteristic of a PN Junction Diode.
23. Construct and test Zener diode as a voltage regulator. Also, plot the Graph.
24. Build and test half wave rectifier circuit. Also, trace the input and output waveforms.

25. Build and test full wave bridge rectifier circuit (without filter). Also, trace the input and output waveforms.
26. Construct a circuit to verify the truth tables of NOT and AND gates.
27. Construct a circuit to verify the truth tables of OR, NOR gates.
28. Construct a circuit to verify the truth tables of NAND and AND gates.
29. Conduct an experiment to verify the truth tables of given logic gates.
30. Identify and draw the layout diagram for a simple PANEL BOARD consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.

Lab Equipment Requirement:

Students Intake : 60
Students per Batch : 20

Sl. No.	Name of Equipment and Specification	Quantity Required
1	Dual Channel 30 V, 2 A continuously variable DC Regulated Power Supply with Current and Overload Protection	05 Nos.
2	+/- 15 V, 2 A, fixed DC Regulated Power Supply	05 Nos.
3	Portable Moving Coil DC Voltmeters a) 0 - 1 V b) 0 - 10 V c) 0 - 30 V	Each 05 Nos.
4	Portable Moving Iron AC Voltmeters a) 0 - 300 V b) 0 - 600 V	Each 05 Nos.
5	Portable Moving Coil DC Ammeters a) 0 - 100 mA b) 0 - 1 A c) 0 - 2 A	Each 05 Nos.
6	Portable Moving Iron AC Ammeters a) 0 - 2 A b) 0 - 5 A c) 0 - 10 A	Each 05 Nos.
7	Watt-meters a) 150/ 300V, 2 A, UPF b) 300/ 600 V, 5/ 10 A, LPF	Each 02 Nos.
8	Rheostats – 25 Ohms, 50 Ohms, 150 Ohms, 220 Ohms (all rated at 3 A)	Each 05 Nos.
9	Rheostat Loads s – 1 KW, 230 V	02 Nos.
10	Wire wound Resistors- 5 Ohms 2 Watts, 25 Ohms 5 Watts, 330 Ohms 2 Watts, 560 Ohms 2 Watts, etc.	Each 05 Nos.
11	Soldering Iron 60 W	05 Nos.
12	Fluorescent lamp sets	10 Nos.
13	Single Phase Energy meter 10 A, 230 V, 50 Hz, Digital type	05 Nos.
14	Multi-meter Digital ¾"	06 Nos.
15	Duel Trace Oscilloscope – 30 MHz	02 Nos.
16	Three Phase Induction Motors :1 HP – 440 V 50 Hz,2 HP – 440 V 50 Hz.	Each 02 Nos.
17	Three phase DOL, Star-Delta, Auto transformer starter	Each 02 Nos.
18	UPS 1 KVA	01 Nos.
19	Battery Lead-Acid type, 140 A-hr and Hydrometers	02 Nos.

Sl. No.	Name of Equipment and Specification	Quantity Required
20	I C Trainer kit	05 Nos
21	Digital IC's 7400, 7402, 7404, 7408, 7486 etc	Each 10 Nos.
22	Wooden Wiring board (2x3) ft	10
23	Wiring accessories a) PVC conduit - ¾" - 10 lengths b) Cap and casing - ¾" - 10 lengths c) Switches Single Pole- 5A, 230 V d) Switches two way – 5 A, 230 V e) 3 Pin Sockets 5A, 230 V f) Bulb Holders – 5 A, 230 V g) 3 Pin Plug 5A, 230 V h) 60 Watts Lamps i) 100 Watts Lamps j) 15 W CFL lamps k) Copper Wires of sizes 1.5 mm^2, 2.5 mm^2, 4 mm^2 – 1 coil each l) Gang boxes (1+1, 2+1, 2+2) m) Kit –Kat fuses 5A, 15 A n) MCB 16 A & 32 A/ 230 V, Single and Double Pole o) ELCB 16 A & 32 A/ 230 V, Double Pole p) Neutral link- 16 A, 230 V q) Screws of assorted sizes r) Testers	Each 10 Nos.
24	Electronic Components a) Diodes - BY 127 and IN 4001 b) Zener Diodes – 6.2 V, 5.6 V, 7.8 V c) Relays – solid state Sugar cube type, SPST, Coil 6V, Power circuit 230 V, 5 A. d) Spring Boards e) Bread Boards f) Tag Boards.	Each 10 Nos.
25	Simple PANEL BOARD/ CUBICAL consisting of bus-bars, CB/MCB/ELCB, meters, HRC fuses, magnetic contactors, cables, earthing points.	1 No

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **STRENGTH OF MATERIALS**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME31T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE-100 Marks

Prerequisites: Knowledge of basic mathematics and Science.

Course Objectives: It aims at enabling the student to understand & analyze various types of loads, stresses & strains along with main causes of failure of machine parts.

1. The subject is pre-requisite for understanding principles of Machine design.
2. Understanding mechanical properties of materials will help in selecting the suitable materials for various engineering applications

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Understand and distinguish the behavior of simple load carrying members subjected to an axial, shear and thermal Loading.	*R/U/A*	1,2,3,9	**14**
CO2	Interpret the Variation of moment of inertia for different Mechanical Engineering Sections such as fly wheel	*R/U/A*	1,2,4,9	**10**
CO3	Draw and Compare the shear force and bending moment diagram on beams under varying load conditions.	*R/U/A*	1,2,4,9	**12**
CO4	Assess Bending and shear stresses in beams subjected to different loadings for different machine parts	*R/U/A*	1,2	**07**
C05	Differentiate in strain energy stored in a body when the load is suddenly applied and gradually applied	*U/A*	1,2	**03**
C06	Design simple solid and hallow shaft for power transmission keeping view of Environmental and sustainability aspects	*R/A*	1,2,6	**06**
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
STRENGTH OF MATERIALS	3	3	1	3	-	1	-	-	3	-

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	SIMPLE STRESSES AND STRAINS	14	05	05	20	30	21
2	MOMENT OF INERTIA	10	05	05	20	30	21
3	SHEAR FORCE AND BENDING MOMENT	12	05	05	20	30	21
4	THEORY OF SIMPLE BENDING	07	05	05	20	30	21
5	STRAIN ENERGY AND IMPACT LOADING	03	-	05	05	10	06
6	TORSION OF CIRCULAR SHAFT	06	05	--	10	15	10
	Total	52	25	25	90	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: SIMPLE STRESSES AND STRAINS   14 Hrs

Simple stresses & strains viz. tensile, compressive, Shear, Crushing, Thermal stresses, & corresponding strains,Hook's Law –Problems on Direct Stress & Linear Strain- Stress- Strain curve for Ductile material and Brittle material with all parameters.- factor of Safety. Elastic Constants - Lateral Strain ,Poisson's ratio, Bulk Modulus, Shear Modulus ,Volumetric Strain-Relation between elastic constants- Problems on elastic constants. Hoop stress-Longitudinal Stress in thin cylindrical & spherical shells subjected to internal pressure.-Problems on thin cylindrical shells.

UNITII: MOMENT OF INERTIA   10Hrs

Centre of Gravity, Moment of Inertia & its Importance -Parallel & Perpendicular Axis Theorem-C.G of Rectangle, Triangle, Circle, Semi-circle, Trapezium, Cone-Problems on

finding CG of T-Section, I-Section, L-Section, Channel-Section. Moment of Inertia of solid &Hollow sections like Rectangle, Triangle, Circle- Moment of Inertia about C.G for I section, T section. L-section and Channel Section.

UNTIII: SHEAR FORCE AND BENDING MOMENT DIAGRAMS   12Hrs

Definition - Shear Force and Bending Moment –Types of beams, types of load acting on beams ,Sagging & Hogging Bending Moment and its importance –sign convention to draw SFD and BMD- Concept of Maximum bending moment, Point of Contra flexure & its importance-Drawing S.F & B.M Diagram for Cantilever, Simply Supported Beams subjected to Point Load and U.D.L

UNIT IV:THEORY OF SIMPLEBENDING   07Hrs

Introduction, assumptions in theory of simple bending.-Bending stress, relation between bending stress & radius of curvature (without proof).-Position of neutral axis, moment of resistance-Bending equation (without proof)-Modulus of section for rectangular, hollow rectangular and hollow circular sections-Beams of uniform Strength-problems

UNIT V: STRAIN ENERGY AND IMPACT LOADING   03Hrs

Introduction -Strain Energy-Types of loading-Sudden, Gradual & Impact Load-resilience, proof resilience and modulus of resilience-Equation for strain energy stored in a body when the load is gradually applied and suddenly applied – problems.

UNIT VI: TORSION OF CIRCULAR SHAFT   06Hrs

Introductionto Torsion , Angle of Twist , Polar Moment of Inertia , Torsion equation-(without proof)-Assumptions in theory of Torsion -Power Transmitted by a shaft, axle of solid and hollow sections subjected to Torsion - Comparison between Solid and Hollow Shafts subjected to pure torsion- Problems. (No problem on composite and non homogeneous shaft)

TEXT BOOKS

1. Ramamurtham. S., *"Strength of Materials",* 14th Edition, Dhanpat Rai Publications, 2011
2. Khurmi R S, *"Applied Mechanics and Strength of Materials",* 5 Edition, S.Chandand company

REFERENCES

1. Popov E.P, *"Engineering Mechanics of Solids",* 2nd Edition, Prentice-Hall of India, New Delhi, 2002.
2. Nash W.A, *"Theory and problems in Strength of Materials",* Schaum Outline Series, McGraw-Hill Book Co., New York, 1995.

3. Kazimi S.M.A, *"Solid Mechanics"*, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
4. Ryder G.H, *"Strength of Materials",* 3rd Edition, Macmillan India Limited, 2002.
5. Bansal R. K, *"Strength of Materials",* Laxmi Publications, New Delhi, 2012.
6. Timoshenko S.P, *"Elements of Strength of Materials",* Tata McGraw-Hill, Delhi,

LIST OF SOFTWARE/LEARNING WEBSITES

1. www.nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024htm

2. www.wikipedia.org/wiki/Shear_and_moment_diagram

3. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf

4. www.engineerstudent.co.uk/stress_and_strain.html

5. https://www.iit.edu/arc/workshops/pdfs/Moment_Inertia.pdf

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one).

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Calculate Moment of Inertia of Fly Wheel of engine present in your laboratory
2	Market Survey specific to properties of Various type of Materials used in Mechanical Engineering and make report
3	Compare the strength of solid shaft with that of hallow shaft for same power transmission for an automobile and make report

Course Delivery:
- The course will be delivered through lectures and Power point presentations/ Video.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

			RUBRICS FOR ACTIVITY(5 Marks)			
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
					Average / Total marks=(4+5+3+2)/4=14/4=3.5=4	

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Report/Log of activity	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: **The following documents to be verified by CIE verifier at the end of semester**

1. Blue books(20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	Strength of Materials	20
	Year:	Course code:15ME31T	

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	III SEM	Strength of Materials	20
	Year: 2015-16	Course code:15ME31T	

Name of Course coordinator :   Units:1, Co: 1,2,3.9

Note: Answer all questions

Question no	Question	CL	CO	PO
1	Explain linear and lateral strain 3 MARKS	U	1	1,2,3,9
2	A bar of 30mm diameter is subjected to an axial pull of 80KN. The measured extension is 0.1 mm on a gauge length of 200mm and the change in diameter is 0.004mm. Calculate the poison's ratio and the values of young's Modulus, bulk modulus and Modulus of rigidity. 7 MARKS	A	1	1,2,3,9
3	A mild steel bar of 15mm diameter was subjected to tensile test. The test bar was found to yield at a load of 90KN and it attains maximum	A	1	1,2,

6

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		3,9
load of 180KN and ultimately fails at a load of 67.5 KN. Determine the following: tensile stress at the yield point, ultimate stress and stress at the breaking point, if the diameter of the neck is 7.5mm.

OR

A bar of steel 1m long 50mm wide and 10mm thickness is subjected to an axial load of 10KN in the direction of its length. Find the changes in length, width, thickness and volume.10 MARKS | | |

MODEL QUESTION PAPER (SEE)
Diploma in Mechanical Engineering
III Semester
Course title: STRENGTH OF MATERIALS

(Answer any 6 questions from part A and Any 7 from Part B)

PART-A(Each questions carries 5 marks)
1. Define bulk Modulus and Shear Modulus
2. Explain thermal stress and Shear Modulus
3. State Parallel and perpendicular axis theorem
4. Locate CG for Triangle Rectangle, Circle, Semi-circle, Trapezium, Cone with the help of plain figure
5. Define Shear force and Bending Moment in beams
6. Explain Point of Contra flexure in a beam
7. List the aassumptions in theory of simple bending
8. Explain Beams of Uniform Strength
9. Explain Strain energy and Resilience

PART-B(Each questions carries 10 marks)
1. A steel rod 30mm x 12.5mm and 500mm long is subjected to a axial pull of 75KN. Determine the changes in length, width and thickness and volume of bar. If young's modulus is 200KN/mm^2.
2. A bar of 30mm diameter is subjected to an axial pull of 80KN. The measured extension is 0.1 mm on a gauge length of 200mm and the change in diameter is 0.004mm. calculate the poisson's ratio and the values of young's Modulus, bulk modulus and Modulus of rigidity.
3. An I section consists of top flange 100 X 30 mm, bottom flange 200 X 40 mm and web 180 X 20 mm. Find the M.I. about an axis passing through C.G. parallel to the base.

4. Calculate M.I. of an angle section 100 X 80 X 10 mm about an axis passing through the centroid and parallel to shorter leg.

5. A cantilever of length 3 m carries a uniformly distributed load of 1.5 KN/m for entire length and a point load of 2 KN at a distance of 1 m from the free end. Draw the shear force and the bending moment diagrams for the beam.

6. A simply supported beam of length 5 m carries point loads of 2 KN and 4 KN and 5 KN at a distance of 1 m, 3 m and 4 m from left support. Draw S.F. and B.M. diagrams for the beam.

7. A steel plate is bent into a circular arc of radius 10m.The plate is 100mm wide and 15mm thick, assuming the value of $E=2X10^5$ N/mm^2.Find the maximum stress induced in the plate and value of bending moment which produced this stress.

8. A simply supported wooden beam of span 1.3 m is carrying a central point load of 40 KN. If the allowable bending stress in the timber is taken as 8 N/mm^2, find the breadth and depth of the timber. Take b=0.6d.

9. (a).List the assumptions made in theory of Torsion   -5M

b)An axial pull of 25KN is suddenly applied on a steel rod of 3 m long and 900mm^2 in cross-sectional area. Calculate the strain energy stored in the rod. Take young's modulus is $2x10^5$ N/mm^2.   −5M

10. A solid circular shaft is required to transmit 80KW at 160 rpm. The permissible shear stress in the shaft is 60 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 20% more than mean torque. The angle of twist is not to exceed 10 in a length of 20 times the diameter of the shaft. The valve of rigidity modulus is 0. $8x10^5$ N/mm2.

MODEL QUESTION BANK
Diploma in Mechanical Engineering
III Semester
Course title: STRENGTH OF MATERIALS

CO I: Understand and distinguish the behavior of simple load carrying members subjected to an axial, shear and thermal Loading.

LEVEL: REMEMBER QUESTIONS

1. Define Poisson's ratio and Modulus of Rigidity
2. Define bulk Modulus and Shear Modulus
3. Describe maximum stress and factor of safety

LEVEL: UNDERSTANDING QUESTIONS

4. Explain linear and lateral strain
5. Explain thermal stress and volumetric strain
6. Explain Hoop's stress and longitudinal stress in thin cylindrical shells
7. Explain thermal stress and Shear Modulus

LEVEL: APPLICATION QUESTIONS

8. Relate between elastic constants

9.Draw stress strain diagram for Ductile materials with all parameters

10.Draw stress strain diagram for Brittle materials with all parameters

11..A load of 5KN is to be raised with the help of a steel wire. Find the diameter of the steel wire, if the stress is not to exceed 100MPa.

12.A tensile test is performed on a brass specimen 10mm in diameter using a gauge length of 50mm. When applying axial tensile load of 25KN, it was observed that the distance between the gauge marks increase by 0.152mm, calculate modulus of elasticity of brass.

13.A punch with a diameter 20mm is used to punch a hole in an aluminium plate of thickness 4mm .If the ultimate shear stress for the aluminium is 275MPa, what force P is required to punch through the plate.

14.The following data pertains to a tension test conducted in laboratory:

  i. Diameter of the specimen = 15mm
  ii. Length of the specimen = 200mm
  iii. Extension under a load of 10 KN=0.035mm
  iv. Load at yield point = 110KN
  v. Maximum load = 190 KN
  vi. Length of the specimen after failure = 255mm
  vii. Neck diameter = 12.25mm

Determine: i) Young's modulus, ii) Yield stress iii) Ultimate stress, iv) Percentage elongation, v) percentage reduction in area, vi) safe stress adopting factor of safety of 1.5.

15.A rod of diameter 15mm and 50mm long is subjected to tensile load of 25KN. The modulus of elasticity for steel rod may be taken as 200 KN/mm^2. Find stress, strain and elongation of the bar due to applied load.

16.A rod of cross sectional area 15mm x 15mm and 1m long is subjected to a compressive load of 22.5KN. calculate the stress and decrease in length if young's modulus is 200GN/m^2.

17.A load of 4KN is to be raised with the help of a steel wire. The permissible tensile stress should not exceed 70N/mm^2. What is the minimum diameter of wire required? What will be extension for 3.5m length of wire? Assume young's modulus is 196.2 GN/m^2.

18.A mild steel bar of 15mm diameter was subjected to tensile test. The test bar was found to yield at a load of 90KN and it attains maximum load of 180KN and ultimately fails at a load of 67.5 KN. Determine the following: tensile stress at the yield point, ultimate stress and stress at the breaking point, if the diameter of the neck is 7.5mm.

19.The following data pertains to a tension test conducted in laboratory:

i.   Diameter of the specimen = 20mm
ii.   Gauge Length of the specimen = 100mm
iii. Final length=130mm
iv.   Final diameter =11.5mm
v.   Yield Load = 92KN
vi.   Ultimate load = 165 KN

Determine: i) Yield stress ii) Ultimate tensile stress, iii) Percentage elongation, iv) percentage reduction in area.

20. A hallow steel column has to carry an axial load of 3MN. If the external diameter of the column is 300mm, find the internal diameter. The ultimate stress for steel is to be 480N/mm^2. Take factor of safety as 4.

21. A short column has an internal diameter of 200mm. What should be the minimum external diameter so that it may carry a load 1600KN with factor of safety 7.5. Take ultimate stress of steel as 472N/mm^2.

22. A steel rod 30mm x 12.5mm and 500mm long is subjected to a axial pull of 75KN. Determine the changes in length, width and thickness and volume of bar. If young's modulus is 200KN/mm^2.

23. A steel bar 2.4 long and 30mm square is elongated by a load 400KN. If poisons ratio is 0.25 find the increase in volume. Assume E=200KN/mm^2.

24. The young's modulus for a given material is 100KN/mm^2 and its modulus of rigidity is 40KN/mm^2. Determine its bulk modulus and also its lateral contraction if the diameter is 50mm and length 2m and extension 2mm.

25. A bar of steel 1m long 50mm wide and 10mm thickness is subjected to an axial load of 10KN in the direction of its length. Find the changes in length, width, thickness and volume.

26. A bar of 30mm diameter is subjected to an axial pull of 80KN. The measured extension is 0.1 mm on a gauge length of 200mm and the change in diameter is 0.004mm. calculate the poisson's ratio and the values of young's Modulus, bulk modulus and Modulus of rigidity.

CO 2: Interpret the Variation of moment of inertia for different Mechanical Engineering Sections such as fly wheel

LEVEL: REMEMBER

1. Define centre of Gravity and Moment of Inertia
2. State Parallel and perpendicular axis theorem

LEVEL: UNDERSTANDING

3. Locate CG for Triangle Rectangle, Circle, Semi-circle, Trapezium, Cone with the help of plain figure

LEVEL: APPLICATION

4. Determine the centroid of the T-section of a flange 100 X 10 mm. Also find the M.I. of the section about XX axis through centroid.
5. Find the centre of gravity of the I-section having top flange of 100 X 20 mm, web 120 X 20 mm and bottom flange 150 X 20 mm. Also find M.I. of the section about XX axis passing through C.G. of the section.
6. Find the C.G. of L-section of dimensions 100 X 80 X 20 mm. Also find the M.I. of the section through C.G. and parallel to shorter leg.
7. Find the moment of Inertia about the centroidal axis XX and YY of the T-section 160 mm wide and 160 mm deep. The flange and web thickness 50 mm each.
8. Find the M.I. about the centroidal XX axis parallel to the flange for the T-beam. Size of the flange120 X 20 mm, size of web 120 X 20 mm.
9. An I section consists of top flange 100 X 30 mm, bottom flange 200 X 40 mm and web 180 X 20 mm. Find the M.I. about an axis passing through C.G. parallel and perpendicular to the base.
10. Calculate M.I. of an angle section 100 X 80 X 10 mm about an axis passing through the centroid and parallel to shorter leg.
11. Calculate the C.G. and moment of inertia for a Channel section of size 100 X 100 X 20 mm about XX and YY axis.

C0 03: Draw and Compare the shear force and bending moment diagram on beams under varying load conditions.

LEVEL: REMEMBER
1. Define Shear force and Bending Moment in beams
2. Name the types of loads acting on beams with illustration

LEVEL: UNDERSTANDING

3. Explain Sagging and Hogging bending Moment
4. Explain Point of Contra flexure in a beam

LEVEL: APPLICATION

5. A cantilever beam of length 3m subjected to a point load of 5 KN, 8KN and 12 KN at a distance of 1m, 1.5m and 2.5m from the free end. Draw SFD and BMD.
6. A cantilever beam of length 4m subjected to a point load of 3 KN, 5KN and 8 KN and 10 KN at a distance of 1m, 1.5m and 3m and 3.5 m from the free end. Draw SFD and BMD.
7. A cantilever beam of length 3 m subjected to two point loads of 10 KN acting at the free end and 15KN at the middle of the beam. Draw SFD and BMD.
8. A cantilever beam 1.5 m long carries point loads of 1 KN, 2KN and 3 KN at 0.5 m, 1.0 m and 1.5 m from the fixed end respectively. Draw the SFD and BMD for the beam.
9. A cantilever beam of 1.4 m length carries a uniformly distributed load of 1.5 KN/m over its entire length. Draw S.F and B.M diagrams for the cantilever.

10. A cantilever AB 1.8 m long carries a point load of 2.5 KN at its free end and a uniformly distributed load of 1 KN/m from A to B. Draw the shear force and the bending moment diagrams for the beam.

11. A cantilever beam of 2 m length carries a uniformly distributed load of 1.5 KN/m over its entire length and also a point load of 3 KN at a distance of 0.5 m from the free end. Draw S.F and B.M diagrams for the cantilever.

12. A cantilever of length 2.5 m carries a uniformly distributed load of 2 KN/m for a length of 2 m from the free end and a point load of 2 KN at the free end. Draw the shear force and the bending moment diagrams for the beam.

13. A cantilever of length 3 m carries a uniformly distributed load of 1.5 KN/m for entire length and a point load of 2 KN at a distance of 1 m from the free end. Draw the shear force and the bending moment diagrams for the beam.

14. A cantilever 5 m long carries point loads of 30 KN and 10 KN at a distance of 1 m from the fixed end. In addition to this the beam carries a UDL of 10 KN/m between point loads. Draw shear force and bending moment diagrams for the cantilever.

15. A simply supported beam of length 6 m carries point loads of 2.5 KN and 4 KN at a distance of 2 m and 4 m from left support. Draw S.F. and B.M. diagrams for the beam.

16. A simply supported beam of length 5 m carries point loads of 2 KN and 4 KN and 5 KN at a distance of 1 m, 3 m and 4 m from left support. Draw S.F. and B.M. diagrams for the beam.

17. A simply supported beam of length 8m carries a UDL of 10KN/m for a distance of 6m from left support. Draw S.F and B.M diagram for the above beam. Also calculate the maximum B.M. on section.

18. A simply supported beam of length 8m carries two point loads of 30KN and 40KN respectively at a distance of 1.5m and 6.5m from the left support. Also it carries a UDL of 10KN/m between the point loads, draw shear force and bending moment diagram.

19. A simply supported beam of 6m span is carrying a UDL of 20KN/m over a length of 3m from right support. Draw S.F d and BMD. Also calculate maximum B.M.

20. Draw S.F and B.M diagram for a simply supported beam 6m long carrying UDL of 2KN/m over the entire length and point loads of 5 KN,4 KN and 3 KN at 3m,4m and 5m from left support respectively.

21. A simply supported beam of span 6m carries two point loads of 5 KN and 10 KN at 1m and 2m respectively from left support and also carries an UDL of 10KN/m over a length of 3m from the right support. Draw SFD and BMD.

CO 04: Assess Bending and shear stresses in beams subjected to different loadings for different machine parts

LEVEL: REMEMBER

1. List the aassumptions in theory of simple bending
2. Describe the relation between Bending Stress and Radius of Curvature
3. Describe the moment of resistance and radius of Curvature in a beam

LEVEL: UNDERSTANDING

4. Explain Beams of Uniform Strength
5. Explain modulus of Section for Rectangular and Circular sections

LEVEL: APPLICATION

1. Write Bending equations with all notation
2. A steel wire of 10mm diameter is bent into circular shape of 5m radius, determine the maximum stress induced in the wire. Take $E=2X10^5$ N/mm^2.
3. A steel plate is bent into a circular arc of radius 10m.The plate is 100mm wide and 15mm thick, assuming the value of $E=2X10^5$ N/mm^2.Find the maximum stress induced in the plate and value of bending moment which produced this stress.
4. The moment of inertia of a beam section 500mm deep is $700X10^6$ mm^4.Find the longest span over which a beam of this section when simply supported could carry a UDL of 40 KN/m. The maximum flange stress in the material is not to exceed 110 N/mm^2.
5. A cast iron pipe of external diameter 65mm and internal diameter of 45mm and of length 5m is supported at its ends. Calculate the maximum bending stress induced in the pipe if it   carries a point load of 100N at its centre.
6. A rectangular beam 300mm deep is simply supported over a span of 4m. What UDL/m the beam can carry if bending stress is not to exceed 120 N/mm^2.
   Take I=$80X10^6$mm^4.
7. A timber joist 150 X 250 mm is simply supported over a span of 3m. If it carries a total UDL of 10 KN/m inclusive of its weight, find the maximum stress induced in the joist.
8. A rectangular beam 300 mm deep is simply supported over a span of 4 m. What UDL the beam may carry if the bending stress is not to exceed 120 MPa. Take I=225 X 10^6 mm^4.
9. A simply supported wooden beam of span 1.3 m is carrying a central point load of 40 KN. If the allowable bending stress in the timber is taken as 8 N/mm^2, find the breadth and depth of the timber. Take b=0.6d.
10. A circular pipe of external diameter 70 mm and thickness 10 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum point load that can be applied at the centre of span if permissible stress in the tube is 150 N/mm^2.
11. .A steel plate is bent into an arc of a circle of radius 10 m. If the breadth of the plate is 150 mm and thickness 25 mm and $E=2X10^5$ N/mm^2, calculate the maximum stress induced in the plate and the bending moment which can produce this stress.
12. A timber is freely supported and has a span of 6 m. If the UDL of 10 KN/m and a point load of 5 KN at a point 3.5 m from left support is loaded. Determine the dimensions of the beam. Assume depth of beam as twice as its breadth. Take f=10 N/mm^2
13. A beam is simply supported and carries UDL of 30 KN/m over the entire span. The section of the beam is rectangular having depth of 400mm. If maximum stress in the material is 120 N/mm^2 and M.I. of the section is 7 X 10^8, find the span of the beam.
14.

CO 05: Differentiate in strain energy stored in a body when the load is suddenly applied and gradually applied

LEVEL: UNDERSTANDING

1. Explain Strain energy and Resilience
2. Explain proof resilience and modulus of resilience
3. Explain Suddenly applied and gradually applied load
4. Explain Suddenly applied and Impact load

LEVEL: APPLICATION

5. Calculate the strain energy stored in a bar 2.5 m long ,50mm wide and 40mm thick when it is subjected to a tensile load of 50KN.Take young's modulus is $2x10^5$ N/mm^2
6. An axial pull of 25KN is suddenly applied on a steel rod of 3 m long and 900mm^2 in cross-sectional area. Calculate the strain energy stored in the rod. Take young's modulus is $2x10^5$ N/mm^2.

CO 06: Design simple solid and hallow shaft for power transmission keeping view of Environmental and sustainability aspects**.**

LEVEL: REMEMBER

1. List the assumptions made in theory of Torsion

LEVEL: APPLICATION

2. Write the torsion equation with all notations
3. Compare the Strength of Hollow and Solid shaft
4. A solid circular shaft is required to transmit 100KW at 200 rpm. The permissible shear stress in the shaft is 70 N/mm^2.Find the diameter of the shaft.
5. A solid circular shaft is required to transmit 90KW at 180 rpm. The permissible shear stress in the shaft is 75 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 20% more than mean torque. Find the suitable diameter of the shaft.
6. .A solid circular shaft is required to transmit 120KW at 180 rpm. The permissible shear stress in the shaft is 70 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 30% more than mean torque. Find the suitable diameter of the shaft. Also find the angle of twist in a length of 2 meter. The valve of rigidity modulus is 0. $9x10^5$ N/mm^2.
7. A solid circular shaft is required to transmit 100KW at 180 rpm. The permissible shear stress in the shaft is 60 N/mm^2. Find the suitable diameter of the shaft. The angle of twist is not to exceed 1^0 in a length of 3 meter. The valve of rigidity modulus is 0. $8x10^5$ N/mm^2.
8. A solid shaft of diameter is 110 mm required to transmit 180KW at 120 rpm. The angle of twist is not to exceed 1.5^0 .Find the length of shaft. The valve of rigidity modulus is 0. $8x10^5$ N/mm^2.
9. A solid circular shaft is required to transmit 40KW at 120 rpm. The permissible shear stress in the shaft is 40 N/mm^2.The maximum Torque transmitted exceeds

the mean torque by 25% more than mean torque. Find the suitable diameter of the shaft.

10. A solid circular shaft is required to transmit 80KW at 160 rpm. The permissible shear stress in the shaft is 60 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 20% more than mean torque. The angle of twist is not to exceed 1^0 in a length of 20 times the diameter of the shaft. The valve of rigidity modulus is 0. 8×10^5 N/mm^2.Find the diameter of the shaft.

11. 8. A solid circular shaft is required to transmit 75KW at 200 rpm. The permissible shear stress in the shaft is 50 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 20% more than mean torque. The angle of twist is not to exceed 1.2^0 in a length of 30 times the diameter of the shaft. The valve of rigidity modulus is 84×10^3N/mm^2.Find the diameter of the shaft.

12. A solid circular shaft is required to transmit 1MW at 240 rpm. The permissible shear stress in the shaft is 60 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 25% more than mean torque. The angle of twist is not to exceed 1^0 in a length of 2.5 meter. The valve of rigidity modulus is 80KN/mm^2.Find the diameter of the shaft.

13. A Hollow shaft is required to transmit 300KW at 90 rpm. The permissible shear stress in the shaft is 60 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 25% more than mean torque. The internal diameter is half of the external diameter, Find the internal diameter and external, diameters of the shaft.

14. A Hollow shaft is required to transmit 500KW at 100 rpm. The permissible shear stress in the shaft is 60 N/mm^2.The maximum Torque transmitted exceeds the mean torque by 15% more than mean torque. The internal to external diameter ratio is 3/5. The angle of twist is not to exceed 1^0 in a length of 3.5 meter The valve of rigidity modulus is 80KN/mm^2.Find the minimum external diameter of the shaft.

15. A solid circular shaft is required to transmit 40KW at 400 rpm. The Ultimate shear stress in the shaft is 360 N/mm^2 with a factor of safety as 8.The maximum Torque transmitted exceeds the mean torque by 15% more than mean torque. Find the diameter of the shaft.

16. If a Hollow shaft is to be used in place of solid shaft, Find the internal diameter and external, diameters of the shaft with the internal to external diameter ratio is 1/2.The material is same

	Course Title: **MECHANICS OF MACHINES**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME32T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Applied Science, Engineering Graphics

Course Objectives:

1. To provide basic concept of kinematics and kinetics of machine elements.
2. To study basics of power transmission.
3. To study the effect of friction.
4. To Study the essentiality of balancing.
5. To acquaint with working principles of CAM Mechanism.
6. To study the different types of vibration and to understand critical speed of shaft

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Analyze and Apply the knowledge of these machines, mechanisms and related terminologies in mechanical engineering science in maintaining sustainable environment and its impact on society	*R/U/A/An*	1,2,3,4,5,6 10	**10**
CO2	Select appropriate power transmission mechanisms	*R/U/A*	1,2,3,4,5,6 10	**11**
CO3	Analyze the effect of friction on machine elements	*U/A/An*	1,2,3,4,5,6, 10	**10**
CO4	Appreciate the essentiality of balancing in Rotating Parts..	*U/A*	1,2,3,4,5,6 10	**07**
CO5	Construct CAM profile for the specific follower motion	*R/U/A*	1,2,3,4,5,6 10	**10**
CO6	Understand the Terminology and types associated with vibration in machine elements	*R/U*	1,2, 10	**04**
			Total sessions	**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICS OF MACHINES	3	3	3	3	3	3	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE/

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	BASIC KINEMATICS	10	5	5	20	30	21
2	TRANSMISSION OF POWER	11	5	5	20	30	21
3	FRICTION	10		5	20	25	17
4	BALANCING	07	--	10	10	20	14
5	CAM MECHANISAMS	10	5	5	20	30	21
6	MECHANICAL VIBRATIONS	04	5	5	--	10	06
	Total	52	20	35	90	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: BASIC KINEMATICS   10Hrs

Definition-Kinematic link or element-Types of links-Kinematic pair–Types-Types of constrained Motions- Kinematic chain- Definition of Machine, Structure and Mechanism-Difference between Machine and Structure ,Mechanism-Inversions-Types of Kinematic Chains-Four Bar Chain- Beam Engine-Coupling Rod of Locomotive-Single Slider Crank Chain- Pendulum Pump-Crank and Slotted Lever Quick Return Motion Mechanism-Double Slider Crank Chain-Elliptical trammel-Scotch yoke mechanism-Oldham's coupling.

UNTII: TRANSMISSION OF POWER   11Hrs

Belt Drives-types of flat belt drives-open, cross, idler pulley, compound, cone pulley and fast and loose pulley. Velocity Ratio, Slip and creep of belt, length of belt, Ratio of driving Tensions, Centrifugal Tension and Initial Tension-Power Transmitted by belts (Flat and V-Belt) and ropes- Maximum power transmitted by belt (without proof)-Problems on belt drives-Introduction to Gears - Classification of Gears-Spur Gear Terminology-Problems on

gears –(centre distance only) Introduction to Gear Trains-Types of Gear trains –Simple, Compound, Reverted and Epicyclic gear trains- Problems on Gear Trains

UNITIII: FRICTION   10Hrs

Friction-Introduction-Types of Friction, Laws of solid friction, coefficient of friction, limiting angle of friction, angle of Repose -Friction in Journal Bearing-Power Transmission in the Journal bearing-Friction in Thrust Bearing-Pivot Bearing– Flat and Conical bearing-Collar Bearing –Problems on bearings (Assuming uniform pressure theory)- Friction in Clutches-Single Disc Clutch- Multiple Disc Clutch- Problems on clutches (Assuming uniform wear theory)-Introduction to Brakes-Internal Expanding Brake (Mechanical & Hydraulic).

UNIT IV:BALANCING   07 Hrs

Introduction-Static and Dynamic balancing-Balancing of single rotating massby a single mass rotating in the same plane -Balancing of several masses rotating in the same plane-Problems on above (Analytical and Graphical methods).

UNIT V: CAM MECHANISAMS   10Hrs

Cams-Introduction-Classification of followers and cams-Terminology of cam- Displacement diagram for the following Motion of follower-Uniform velocity -Simple Harmonic Motion (SHM)-Uniform Acceleration and Retardation Motion (UARM),Cam profile construction for Knife edge follower and Roller follower.

UNIT VI: MECHANICAL VIBRATIONS   04Hrs

Introduction- Terms used in Vibrations-Types of Vibrations-Free Vibrations- Forced Vibrations-Damped Vibrations-Types of Free Vibrations- Longitudinal, Transverse and Torsional- Critical or Whirling speed of a shaft.

TEXT BOOKS

1. Rattan.S.S, "*Theory of Machines*", Tata McGraw -Hill Publishers, New Delhi, 2009.
2. Khurmi R S, Guptha J.K *"Theory of machines ",* 5 Edition, S.Chand and company ,Delhi ISBN 81-219-2524-X

REFERENCES

1. Thomas Bevan, *"Theory of Machines",* CBS Publishers and Distributors, 3rd Edition, 2005.
2. Ramamurti,V., *"Mechanism and Machine Theory",* 2nd Edition, Narosa Publishing House,2005.
3. Ghosh.A and A.K.Mallick, *"Theory of Mechanisms and Machines",* Affiliated East- WestPrivate Limited, New Delhi, 1998.
4. Rao.J.S and Dukkipati R.V, "*Mechanism and Machine Theory",* Wiley-Eastern Limited,New Delhi, 1992.

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. http://nptel.iitm.ac.in/video.php?subjectId=112104121
2. http://www.technologystudent.com/gears1/gears7.htm
3. http://kmoddl.library.cornell.edu/model.php?m=20http://www3.ul.ie/~kirwanp/whatisacamandfollowersyste.htm
4. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/index.htm
5. http://elearning.vtu.ac.in/12/enotes/Des_Mac-Ele2/Unit6-RK.pdf
6. www.tecquipment.com/Theory_of_Machines.aspx
7. www.researchgate.net/.../0094-114X_Mechanism_and_Machine_Theory
8. www.journals.elsevier.com/mechanism-and-machine-theory/
9. www.iftomm.org/
10. www.wiziq.com/online-tests/44047-mechanical-theory-of-machine
11. www.cs.ubc.ca/~murphyk/Teaching/CS340-Fall07/infoTheory.pdf

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	List the mechanisms which you are using in your day to day life. Sketch any three from these. Study and submit handwritten report of 500 words
2	Take a photo of a actual kinematic mechanism used in an automobile, study and submit handwritten report of 500 words
3	Analyse the effect of friction in real situation and submit handwritten report of 500 words
2	List the mechanism used in a typical car. study and submit handwritten report of 500 words
3	Identify and measure the dimensions of Flywheel used in automobile. study and submit handwritten report of 500 words
4	Identify the type of clutches and cams used in different automobiles and also the type of brakes in automobile and bicycle. study and submit handwritten report of 500 words
5	Visit the market and collect the data of items which are used in any mechanisms. Data includes specifications, cost, applications, etc. Also name the mechanism/s in which such item/s is/are use .Study and submit handwritten report of 500 words

Course Delivery

- The course will be delivered through lectures and Power point presentations/ Video
- Teachers can prepare or download PPT of different topics on Mechanisms usage in mechanical engineering application.
- Motivate student to take case study on kinematics, power transmission and to inculcate him for self and continuous learning.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR ACTIVITY(5 Marks)

Dimension	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Student Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
				Average / Total marks=(4+5+3+2)/4=14/4=3.5=4		

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Directorate Of Technical Education   **Karnataka StateMECH**   **15ME32T**

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	IVSEM	**MECHANICS OF MACHINES 15ME32T**	20
	Year: 2016-17	Course code:15ME41T	

Name of Course coordinator :   Units:1,2 Co: 1,2
Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Explain lower pair and higher pairs	05	U	1	1,2,3,4, 5,6,10
2	List the different types of constraint motion Explain any one.	05	R	1	1,2,3,4, 5,6,10
3	A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m.The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is an open belt drive, Take $\mu = 0.3$. **OR** Two parallel shafts are to be connected by spur gearing. The approximate distance between the shafts is 600 mm. If one shaft runs at 120 r.p.m. and the other at 360 r.p.m., Calculate the number of teeth on each wheel, if the module is 8 mm. Also determine the exact distance apart of the shafts.	10	A	2	1,2,3,4, 5,6,10

6

Directorate Of Technical Education   Karnataka StateMECH   15ME32T

IV- Semester Diploma Examination

Course Title: **MECHANICS OF MACHINES**

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. List the different types of constraint motion Explain any one.
2. Explain with a neat sketch bull engine.
3. Explain open belt and cross belt drives.
4. Calculate the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap is 160° and maximum tension in the belt is 2500 N.
5. State the laws of solid friction.
6. Explain the method of balancing of different masses revolving in the same plane.
7. Explain clearly the terms 'static balancing' and 'dynamic balancing'.
8. Construct the displacement and velocity diagram for uniform velocity motion of the follower.
9. Discuss briefly with neat sketches the longitudinal, transverse vibrations

PART-B   7x10=70 marks

10.   a) Explain with a neat sketch beam engine.   06

        b) Differentiate between machine and a structure.   04

11.   a)Explain With a neat sketch double crank mechanism.   05

        b)Sketch and describe Scotch-yoke mechanism.   05

12.   a)List the advantages & disadvantages of flat belt over v-belt drive.   04

        b)Develop the gear when Two parallel shafts, about 600 mm apart are to be connected by spur gears. One shaft is to runat360r.p.m. and the other at 120 r.p.m., if the circular pitch is to be 25 mm. 06

13.   Calculate the width of the belt taking centrifugal tension into account..A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^{3}and thickness of belt 1

        10 mm,   10

14.   a) Explain with a neat sketch, limiting angle of friction.   05

        b) A 60 mm diameter shaft running in a bearing carries a load of 2000 N. If the coefficient of friction between the shaft and bearing is 0.03, Calculate the power transmitted when it runs at 1440 r.p.m.
                                                                                                     -05

15. Five masses A, B, C,D and E are attached to a shaft and revolve in the same plane. The masses of A is 200N, B is 100N, C is 160 N respectively and their radii of rotations are equal. The angular position of the masses B, C , D and E are 60°, 135°, 210⁰ and 270° from the mass A. Calculate the magnitude of D and E for complete balance. Solve graphically   -10

16. Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Calculate the position and magnitude of the balance mass required, if its radius of rotation is 0.2m.(solve Analytically).   -10

17. Construct a cam profile to raise a valve with simple harmonic motion through 50 mm in 1/3 of a revolution, keep if fully raised through 1/12 revolution and to lower it with harmonic motion in 1/6 revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20 mm and the minimum radius of the cam is 25 mm. The diameter of the camshaft is 25 mm. The axis of the valve rod passes through the axis of the camshaft.   -10

18. Define the following terms.   -10
    (a) Base circle, (b) Pitch circle, (c) Pressure angle, and (d) Stroke of the follower.(e)Trace point

19. a)Explain the term 'whirling speed' or 'critical speed' of a shaft   05
    b) Discuss briefly with neat sketches the transverse and torsional free vibrations   05

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MODEL QUESTION BANK

Diploma in Mechanical Engineering
IV Semester
Course title: MECHANICS OF MACHINES

CO1: ANALYZE AND APPLY THE KNOWLEDGE OF THESE MACHINES, MECHANISMS AND RELATED TERMINOLOGIES IN MECHANICAL ENGINEERING SCIENCE IN MAINTAINING SUSTAINABLE ENVIRONMENT AND ITS IMPACT ON SOCIETY

REMEMBERING

1. List the different types of constraint motion Explain any one.
2. Define kinematic link. Briefly explain its types.
3. Define following terms a) structure   b) mechanism.
4. Define kinematic chain? Name the different types of kinematic chains.
5. Define inversion of mechanism.

UNDERSTANDING

1. Explain kinematic chain. give its relation
2. Explain the following terms.
   a) Sliding pair b) turning pair c) screw pair d) spherical pair e) rolling pair
3. Explain lower pair and higher pairs
4. Explain self closed pair and force-closed pair
5. Differentiate between machine and a structure.

6. Classify different kinematic pairs.

1. Explain With a neat sketch completely constrained motion.
2. Explain with sketch four bar chain and mention its inversions.
3. Explain with sketch single slider crank chain and mention its inversions.
4. Explain with sketch double slider crank chain and mention its inversions.
5. Explain with a neat sketch beam engine
6. Explain with a neat sketch four bar chain.
7. Explain With a neat sketch double crank mechanism.
8. Explain With a neat sketch single slider crank chain.
9. Explain with a neat sketch bull engine.
10. Explain with a neat sketch crank and slotted lever quick return motion mechanism.
11. Explain with a neat sketch elliptical trammel.
12. Explain with a neat sketch Scotch yoke mechanism
13. Explain with a neat sketch Oldham's coupling.

CO2 : SELECT APPROPRIATE POWER TRANSMISSION MECHANISMS

REMEMBERING
1. Define the following terms.
2. List the advantages of flat belt over v-belt drive.
3. List the Advantages and Disadvantages of Belt over Rope Drive
4. Define the following terms
   A) Pitch circle. B). Addendum. C).Dedendum. D). Circular pitch.
   E) Diametral pitch. F) Module.

UNDERSTANDING

1. Explain open belt and cross belt drives.
2. Explain the following   a) Velocity ratio   b) slip c) creep.
3. Explain slip and creep of belt drive.
4. Explain centrifugal tension of flat belt.
5. Discuss the various types of gear trains.
6. Explain briefly the reverted gear train
7. Explain briefly the epicyclic gear train
8. Explain with neat diagram belt drive with idler pulley.
9. Explain with neat diagram stepped or cone pulley drive.
10. Explain with neat diagram fast and loose pulley drive.
11. Explain with neat diagram compound belt drive and write its velocity ratio.
12. Explain briefly the compound Gear train with diagram

1. An engine, running at 150 r.p.m., drives a line shaft by means of a belt. The engine pulley is 750 mm diameter and the pulley on the line shaft being 450 mm. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Calculate the speed of the dynamo shaft, when 1. There is no slip, and 2. There is a slip of 2% at each drive.

2. The power is transmitted from a pulley 1 m diameter running at 200 r.p.m. to a pulley 2.25 m diameter by means of a belt. Calculate the speed lost by the driven pulley as a result of creep, if the stress on the tight and slack side of the belt is 1.4 MPa and 0.5 MPa respectively. The Young's modulus for the material of the belt is 100 MPa.

3. Calculate the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap is 160° and maximum tension in the belt is 2500 N.

4. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Calculate the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25 ?

5. A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m.The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is an open belt drive, Take μ = 0.3.

6. A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m3and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.

7. Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 r.p.m. The diameter of the driving pulley of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the centres of two pulleys is 3 metres. The density of the leather is1000 kg/m3. The maximum allowable stress in the leather is 2.5 MPa. The co-efficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt.

8. A pulley is driven by a flat belt, the angle of lap being 120°. The belt is 100 mm wide by 6 mm thick and density1000 kg/m3. If the coefficient of friction is 0.3 and the maximum stress in the belt is not to exceed 2 MPa, Calculate the greatest power which the belt can transmit and the corresponding speed of the belt.

9. In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is 150°. The smaller pulley has a radius of 200 mm and rotates at 500 r.p.m. Calculate the power in kW transmitted by the belt.

10. Two parallel shafts, whose centre lines are 4.8 m apart, are connected by open belt drive. The diameter of the larger pulley is 1.5 m and that of smaller pulley 1 m. The initial tension in the belt when stationary is 3 kN. The mass of the belt is 1.5 kg / m length. The coefficient of friction between the belt and the pulley is 0.3. Taking centrifugal tension into account, calculate the power transmitted, when the smaller pulley rotates at 400 r.p.m.

11. An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 metres apart and transmits 4 kW from the smaller pulley that rotates at 300 r.p.m. Co-efficient of friction between the belt and the pulley is 0.3 and the safe working tension is10N per mm width. Determine: 1. Minimum width of the belt, 2. Initial belt tension and 3. Length of the belt required.

12. Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per meter length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140°. μ = 0.15.

13. A compressor, requiring 90 kW is to run at about 250 r.p.m. The drive is by V-belts from an electric motor running at 750 r.p.m. The diameter of the pulley on the compressor shaft must not be greater than 1 metre while the centre distance between the pulleys is limited to 1.75 metre. The belt speed should not exceed 1600 m/min. Determine the number of V-belts required to transmit the power if each belt has a cross-sectional area of 375 mm2, density 1000 kg/m3 and an allowable tensile stress of 2.5MPa. The groove angle of the pulley is 35°. The coefficient of friction between the belt and the pulley is 0.25.Calculate also the length required of each belt.

14. A rope drive transmits 600 kW from a pulley of effective diameter 4 m, which runs at a speed of 90 r.p.m. The angle of lap is 160° ; the angle of groove 45° ; the coefficient of friction 0.28 ; the mass of rope 1.5 kg / m and the allowable tension in each rope 2400 N. Calculate the number of ropes required.

15. A pulley used to transmit power by means of ropes has a diameter of 3.6 metres and has 15 grooves of 45° angle. The angle of contact is 170° and the coefficient of friction between the ropes and the groove sides is 0.28. The maximum possible tension in the ropes is 960 N and the mass of the rope is 1.5 kg per metre length. Calculate the speed of pulley in r.p.m. and the power transmitted if the condition of maximum power prevail

16. Two parallel shafts, about 600 mm apart are to be connected by spur gears. One shaft is to run at 360 r.p.m. and the other at 120 r.p.m. Develop the gears, if the circular pitch isto be 25 mm.

17. Two parallel shafts are to be connected by spur gearing. The approximate distance between the shafts is 600 mm. If one shaft runs at 120 r.p.m. and the other at 360 r.p.m. Calculate the number of teeth on each wheel, if the module is 8 mm. Also determine the exact distance apart of the shafts.

18. A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter running at 300 r.p.m. The angle of contact is spread over 11/24 of the circumference and the coefficient of friction between belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1.1 Mg/m3 and the related permissible working stress is 2.5 MPa.

CO3: ANALYZE THE EFFECT OF FRICTION ON MACHINE ELEMENTS

UNDERSTANDING

1. Explain the following terms:
   (i).Angle of response (ii).Angle of friction
2. Explain limiting angle of friction.

3. Explain coefficient of friction.
4. Explain with neat diagram limiting angle of friction.
5. Explain with neat diagram coefficient of friction.
6. Explain with neat diagram friction in a journal bearing.

APPLICATION

1. A 60 mm diameter shaft running in a bearing carries a load of 2000 N. If the coefficient of friction between the shaft and bearing is 0.03, Calculate the power transmitted when it runs at 1440 r.p.m.
2. Explain with neat sketch different types of pivot bearings.
3. Explain with neat sketch single and multiple flat collar bearing.
4. A vertical shaft 150 mm in diameter rotating at 100 r.p.m. rests on a flat end footstep bearing. The shaft carries a vertical load of 20 kN. Assuming uniform pressure distribution and coefficient of friction equal to 0.05, Calculate power lost in friction.
5. A conical pivot supports a load of 20 kN, the cone angle is 120º and the intensity of normal pressure is not to exceed 0.3 N/mm2. The external diameter is twice the internal diameter. Calculate the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1, Calculate the power absorbed in friction. Assume uniform pressure.
6. A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120º and the coefficient of friction is 0.025. Calculate the power lost in friction when the speed is 140 r.p.m., assuming uniform pressure.
7. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine90 r.p.m., Calculate the power absorbed in friction at the thrust block, assuming l. uniform pressure only
8. A shaft has a number of a collars integral with it. The external diameter of the collars is 400 mm and the shaft diameter is 250 mm. If the intensity of pressure is 0.35 N/mm2 (uniform) and the coefficient of friction is 0.05, Calculate:1. Power absorbed when the shaft runs at 105 r.p.m. carrying a load of 150 kN ; and 2. Number of collars required.
9. Explain with a neat sketch single plate or disc clutch.
10. Explain with a neat sketch multi plate clutch.
11. A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm2. If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500rpm.
12. A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed 0.127 N/mm2, Calculate the power transmitted at 500 r.p.m. The outer and inner radii of friction surfaces are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3.
13. Explain with a neat sketch internal expanding brake.

UNDERSTANDING

1. Explain the balancing of rotating parts necessary for high speed engines
2. Explain clearly the terms 'static balancing' and 'dynamic balancing'.
3. Discuss how a single revolving mass is balanced by a single mass revolving in same planes.
4. Explain the method of balancing of different masses revolving in the same plane.

APPLICATION

1. Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Calculate the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.(Analytical method)
2. Four masses m1, m2, m3 and m4 are 250 kg, 350 kg, 290 kg and 310 kg respectively. The corresponding radii of rotation are 0.25 m, 0.20 m, 0.35 m and 0.4 m respectively and the angles between successive masses are 45°, 75° and 135°. Calculate the position and magnitude of the balance mass required, if its radius of rotation is 0.25 m. (Graphical method)
3. Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Calculate the magnitude and position of the balancing mass at a radius of 100 mm.
4. Five masses A, B, C,D and E are attached to a shaft and revolve in the same plane. The masses of A is 200N, B is 100N, C is 160 N respectively and their radii of rotations are equal. The angular position of the masses B, C , D and E are 60°, 135°, 210^0 and 270° from the mass A. Calculate the magnitude of D and E for complete balance. Solve graphically.
5. Five masses A, B, C,D and E are attached to a shaft and revolve in the same plane. The masses of A is 250N, B is 160 N, C is 210N respectively and their radii of rotations are equal. The angular position of the masses B, C , D and E are 60°, 135°, 210^0 and 270° from the mass A. Calculate the magnitude of D and E for complete balance. Solve by Analytical method.
6. Four masses m1, m2, m3 and m4 are 100 N, 150 N, 120 N and 130 N respectively. The corresponding radii of rotation are 0.225 m, 0.175 m, 0.25 m and 0.3 m respectively and the angles measured from A are 45°, 120^0 and 255°. Calculate the position and magnitude of the balance mass required, if its radius of rotation is 0.3 m.(Analytical method)
7. Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 16kg, 14 kg, 22kg and 20 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of

the masses B, C and D are 60°, 135° and 270° from the mass A. Calculate the magnitude and   position of the balancing mass at a radius of 50 mm

CO5: CONSTRUCT CAM PROFILE FOR THE SPECIFIC FOLLOWER MOTION

REMEMBERING

1. Define the following terms.
   (a) Base circle, (b) Pitch circle, (c) Pressure angle, and (d) Stroke of the follower.(e)Trace point

UNDERSTANDING

1. Explain cam and follower
2. Classify different types of cams
3. Describe the types of follower.
4. Classify different types of followers.
5. Explain prime circle and pitch circle related to cam profile
6. Explain base circle and pitch point to cam profile
7. Explain pressure angle and lift or stroke related to cam profile
8. Interpret why a roller follower is preferred to that of a knife-edged follower.
9. Illustrate the different types of motion with which a follower can move.

APPLICATION

1. Construct the displacement diagram for uniform velocity and S.H.M motion of the follower
2. Construct the displacement and velocity diagram S.H.M motion of the follower
3. Construct the displacement and velocity diagram for uniform velocity motion of the follower
4. Construct the displacement and velocity diagram for uniform acceleration and retardation motion of the follower.
5. Explain with sketches the different types of cams and followers.

6. Construct a disc cam to give uniform motion to a knife edge follower during out stroke of 50 mm during the first half of the cam revolution. The follower again returns to its original position with uniform motion during the next half of the revolution. The minimum radius of the cam is 50 mm and the diameter of the cam shaft is 35 mm. Draw the profile of the cam when the axis of follower passes through the axis of cam shaft.
7. Construct a cam operating a knife-edged follower, has the following data :
   (a)   Follower moves outwards through 40 mm during 60° of cam rotation.
   (b)   Follower dwells for the next 45°.
   (c)   Follower returns to its original position during next 90°.
   (d)   Follower dwells for the rest of the rotation.
   (e)   The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the

cam is 50 mm. Draw the profile of the cam when the axis of the follower is offset 20mm towards right from the cam axis.

8. Construct a disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple harmonic motion in a radial path for the details given below:
    a) Outstroke with maximum displacement of 25 mm during 120° of cam rotation,
    b) Dwell for 60° of cam rotation,
    c) iii) Return stroke with maximum displacement of 25 mm during 90° of cam rotation, and
    d) Dwell during remaining 90° of cam rotation.
    e) The line of reciprocation of follower passes through the camshaft axis. The maximum radius of camis30 mm. The roller diameter is 8 mm. Draw the profile of the cam when the line of reciprocation of the follower is offset by 20 mm towards right from the cam shaft axis.

9. Construct a cam profile to raise a valve with simple harmonic motion through 50 mm in 1/3 of a revolution, keep if fully raised through 1/12 revolution and to lower it with harmonic motion in   1/6 revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is   20 mm and the minimum radius of the cam is 25 mm. The diameter of the camshaft is 25 mm. The axis of the valve rod passes through the axis of the camshaft.

10. Construct a cam rotating clockwise with a uniform speed is to give the roller follower of 20 mm diameter with   the   following motion:
    i.   Follower to move outwards through a distance of 30 mm during 120° of cam rotation ;
    ii. Follower to dwell for 60° of cam rotation ;
    iii. Follower to return to its initial position during 90° of cam rotation ; and
    iv. Follower to dwell for the remaining 90° of cam rotation.
        The minimum radius of the cam is 30 mm and the line of stroke of the follower is offset 15 mm from the   axis of the cam and the displacement of the follower is to take place with simple harmonic motion on   both   the outward and return strokes. Draw the cam profile.

11. Construct the profile of cam rotating clockwise at a uniform speed of 100 r.p.m. is required to give motion to knife-edge   follower   as   below,
    Follower to move outwards through 40 mm during 120° of cam rotation,
    (f) Follower to dwell for the next 60° of cam rotation,
    (g) Follower to return to its starting position during next 90° of cam rotation, and
    (h) Follower to dwell for the rest of the cam rotation.
    (i) The minimum radius of the cam is 30 mm and the line of stroke of the follower passes through the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and   retardation on both the outward and return strokes.

12. Construct a cam profile with 30 mm as minimum diameter is rotating clockwise at a uniform speed of 1200 r.p.m. and has   to give the   following motion to a roller follower 10 mm in diameter:

(a) Follower to complete outward stroke of 25 mm during 120° of cam rotation with equal uniform acceleration and retardation ;

(b) Follower to dwell for 60° of cam rotation;

(c) Follower to return to its initial position during 90° of cam rotation with equal uniform acceleration and retardation;

(d) Follower to dwell for the remaining 90° of cam rotation.

Draw the cam profile if the axis of the roller follower passes through the axis of the cam.

13. Construct a cam profile, rotating clockwise at a uniform speed of 200 r.p.m. is required to move an offset roller follower with a uniform and equal acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell (between ascent and descent) and the angle of descent is 120°, 60° and 90° respectively. The follower dwells for the rest of cam rotation. The least radius of the cam is 50 mm, the lift of the follower is 25 mm and the diameter of the roller is 10mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam.

14. Construct the profile of a cam to suit the following specifications:
Cam shaft diameter = 25mm; Least radius of cam = 30 mm ; Diameter of roller = 20 mm;
Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm ; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set12.5 mm from the centre of the cam.

15. Construct the profile of a cam to give the following motion to a knife-edged follower:
Outstroke during 60° of cam rotation: 2. Dwell for the next 30° of cam rotation; Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam Rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during the outstroke and return strokes. With uniform velocity. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of the cam shaft.

CO6:	UNDERSTAND THE TERMINOLOGY AND TYPES ASSOCIATED WITH VIBRATION IN MACHINE ELEMENTS

REMEMBERING

1. Define free vibrations, forced vibrations.
2. Identify the causes and effects of vibrations?
3. Define free vibrations,. And damped vibrations.
4. Define forced vibrations,. And damped vibrations.

UNDERSTANDING

1. Discuss briefly with neat sketches the longitudinal, transverse vibrations.
2. Discuss briefly with neat sketches the transverse and torsional free vibrations.
3. Discuss briefly with neat sketches the longitudinal, and torsional free vibrations.
4. Explain the term 'whirling speed' or 'critical speed' of a shaft

Course Title: **MECHANICAL MEASUREMENTS**		
Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME33T**
Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks		SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Science. Basic Electrical and Electronics Engineering

Course Objectives:

1. Understand the advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
2. To learn various flow measurement techniques.

On successful completion of the course, the students will be able to CO:

NOTE: The theory should be taught in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

Course Outcomes:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Know the terms of the measurements, and Understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions	*R/U/A*	1,2,3,10	**12**
CO2	Appreciate Measurement of strain by using a basic strain gauge and hence verify the stress induced and application of transducers in mechanical engineering applications for sustainable development	*R/U/A*	1,2,3,10	**10**
CO3	Apply the principles of instrumentation for transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress in mechanical engineering applications for sustainable development	*R/U/A*	1,2,3,6, 10	**15**
CO4	Apply the principles of Miscellaneous measurements for humidity, density, level and blood pressure.	*U/A*	1,2,3,4,6, 10	**06**
CO5	Apply the principles of limits, fits, tolerance and Analyse the process alignment testing of machine tools for manufacturing field.	*R/U/A*	1,2,3,4,6, 10	**09**
		Total sessions		**52**

R-Remember; U-Understanding; A-Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL MEASUREMENTS	3	3	3	1	-	2	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	**Measuring instruments**	12	10	10	10	30	21
2	**Transducers and strain gauges**	10	5	10	15	30	21
3	**Measurement of force, torque, and pressure**	06	05	05	10	20	14
4	**Applied mechanical measurements**	09	05	05	15	25	17
5	**Miscellaneous measurements**	06	--	5	10	15	10
6	**Limits, Fits, Tolerance & Testing of Geometric Dimensions**	09	5	10	10	25	17
	Total	52	30	45	70	145	100

R-Remember; U-Understanding; A-Application

UNITI: MEASURING INSTRUMENTS   12Hrs

Measurement-definition-methods of measurement-Significance-Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration -Errors in Measurements-Systematic and Random error. Measuring instruments- Factors in selecting the measuring instruments -Thread measurements:-Bench micrometer- Thread gauge micrometer- Angle measurements- Bevel protractor, Sine Bar, Gauges: plain plug gauge, snap gauge, ring gauge-.Surface finish-Measurement of surface finish by Talysurf surface roughness tester-Co-ordinating measuring machine.

UNTII: TRANSDUCERS AND STRAIN GAUGES   10 Hrs

Transducers- concept-Characteristics, Transducers selection factors, classifications of Transducer, actuating mechanisms. Voltage and current generating analog transducers-Types-Piezoelectric transducer. Strain Measurements: Strain gauge, Classification, Berry-type mechanical strain gauge, optical strain gauges, mounting of strain gauges, Strain gauge rosettes-two and three elements, Gauge factor

UNITIII: MEASUREMENT OF FORCE, TORQUE, AND PRESSURE   06Hrs

Force measuring devices- Spring Balance, Proving ring, Strain guage type Load cell- Torque measuring devices- Prony brake, Hydraulic dynamometer-.pressure measuring devices- -Diaphragm type pressure gauge- Bourdon tube pressure gauge- Mcloed gauge, Construction, working and applications.

UNIT IV: APPLIED MECHANICAL MEASUREMENTS   09Hrs

Speed measurement- Classification of tachometers. Working principle, construction, working of Revolution counters and Eddy current tachometers. Displacement measurement- Working principle, construction, working of Linear variable Differential transformers (LVDT)-Flow measurement- Working principle, construction, working of Rotometers-Temperature measurement. Principle, construction, working of Resistance thermometers and Optical Pyrometer, Thermocouples.

UNIT V: MISCELLANEOUS MEASUREMENTS   06 Hrs

Humidity measurement–construction, working of hair hygrometer-Density measurement-Measurement of density using hydrometer, Liquid level measurement –-Measurement of liquid level by using sight glass, Float gauge-Biomedical measurement- construction, working of Sphygmo monometer

UNITVI: LIMITS,FITS,TOLERENCE & TESTING OF GEOMETRIC DIMENSIONS
                                                                        09 Hrs

Concepts- Interchangeability, Selective Assembly, Basic Definitions, Graphical illustration of limits and Tolerances. Fit-Classification of fits. Systems of fits-Hole Basis System and Shaft Basis system, Systems of tolerancing-Unilateral System and Bilateral System, Machine tools alignment testing-Checking Parallelism, Straightness, runout, alignment testing of machine tool during erection as per IS standard procedure

TEXT BOOKS

1. *Mechanical Engineering Measurement* - Thomas Beckwith, N.Lewis Buck, Roy Marangoni - *Narosa Publishing House, Bombay*

REFERENCES

1. *Mechanical Engineering Measurements* - A. K. Sawhney - *DhanpatRai& Sons, New Delhi.*
2. *" Metrology & Measurement"* by Anand K Bewoor,Vinay kulakarni ,Tata McGraw hill New delhi 2009
3. *"Principles of Engineering metrology"* by Rega Rajendra Jaico publishers-2008
4. *"Dimensional Metrology "*by Connie Dotson, DELMAR ,cenage learning,2007
5. *"Engineering Metrology"* by R.K.Jain, Khanna Publishers, 1994

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. http://en.wikipedia.org/wiki/Metrology (metrology).
2. https://www.youtube.com/watch?v=4hlNi0jdoeQ (vernier).
3. https://www.youtube.com/watch?v=FNdkYIVJ3Vc(vernier).
4. https://www.youtube.com/watch?v=O8vMFFYNIfo (micrometer)
5. https://www.youtube.com/watch?v=h98HPVuWjLA (depth micrometer)
6. https://www.youtube.com/watch?v=SmXfGan_NXQ (telescopic gauge)
7. http://www.authorstream.com/Presentation/007sandeepks-1858141-angular-measurment/ (angular measurement).
8. http://askguru.net/t-Angular-Measurement-ppt
9. https://www.youtube.com/watch?v=aBzh6i5fQ70 (surface roughness)
10. https://www.youtube.com/watch?v=S7SXD6sKQ-I(surface roughness)
11. https://www.youtube.com/watch?v=eVpoJzLJa0U(surface roughness)
12. https://www.youtube.com/watch?v=3Od7vnoMwGg(surface roughness)
13. https://www.youtube.com/watch?v=XnLiTPGE6pk (three wire thread measurement)
14. https://www.youtube.com/watch?v=Gdvtw0pTAOs (thread pitch).
15. https://www.youtube.com/watch?v=qMgXGedDffw (dial indicator)
16. http://www.authorstream.com/Presentation/donzvasanth-1501139-unit-2-linear-angular-measurement/
17. http://en.wikipedia.org/wiki/List_of_gear_nomenclature#Addendum (gear nomenclature).

18. https://www.google.co.in/search?q=gear+tooth+vernier+caliper&tbm=isch&tbo=u& source=univ&sa=X&ei=MIuEUsqSOsiKrQeywIFQ&ved=0CCgQsAQ&biw=1600& bih=804 (gear tooth vernier).
19. http://www.youtube.com/watch?v=lc4dsNvm2Ks (principle of mech. meas).
20. http://www.youtube.com/watch?v=nv3GuJArjNU (Transducers).
21. http://www.youtube.com/watch?v=iMIzApq1CQ0 (pressure measurement).
22. http://www.youtube.com/watch?v=JKuoQ5FV2c8 (temperature meas.).
23. http://www.youtube.com/watch?v=GNOI_7ftbQ0(temperature meas.) .
24. http://www.youtube.com/watch?v=7xUdPVpafyI (flow measurement).
25. http://www.ignou.ac.in/upload/Unit-4-62.pdf (limit gauges).
26. http://www.scribd.com/doc/55242715/8/Types-of-limit-gauges
27. http://www.youtube.com/watch?v=v25PCV_IJCw (sensors)
28. http://www.youtube.com/watch?v=QItuf6lNvmI(sensors)
29. http://www.youtube.com/watch?v=pOvTyvBqzgM (displacement sensors)
30. http://www.youtube.com/watch?v=inLkCOwVgyM (force sensors)
31. http://www.youtube.com/watch?v=jxv0ITAr74A(force sensors)
32. http://www.youtube.com/watch?v=0MP_9n08urA(force sensors)
33. http://www.youtube.com/watch?v=zAddvPHfKnw(force sensors)
34. http://www.youtube.com/watch?v=_fQSMVf3hdM (calibration).
35. http://www.youtube.com/watch?v=HwSxBRaxn_4(calibration).
36. http://www.youtube.com/watch?v=ZymDMUuVuyY (geometrical Tol.)
37. http://www.gobookee.org/measurement-of-geometric-tolerances-in-manufacturing/
38. http://www.me.metu.edu.tr/courses/me410/exp1/410exp1theory.pdf
39. http://www.youtube.com/watch?v=5eaSkU6Ecik (flatness measurement)
40. http://www.youtube.com/watch?v=1tBnpzyhVXU (measuring straightness)

41. http://www.youtube.com/watch?v=1JNCe9fwRUw (measuring perpendicularity)
42. http://www.youtube.com/watch?v=eJ8a0k8kQIE(Roundness and cylindricity)

Course Delivery:
- The course will be delivered through lectures and Power point presentations/ Video
- Teachers can prepare or download ppt of different topic's measuring instruments usage in mechanical engineering application, can prepare alternative slides.

SUGGESTED LIST OF STUDENT ACTIVITYS
Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Each student will select and bring at least one mechanical component. Sketch each component. Sketch and label main parts of instruments to be used. Calculate least count of the instrument/s to be used. Measure and record applicable dimensions of each

	component using suitable instrument
2	Sketch the part and setup, list the instruments used, list the steps followed and record the observations for checking straightness
3	Select appropriate limit gauge for given dimension/part and check the dimension with gauge.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5
				Student Activities	05	activities sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code		Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**MECHANICAL MEASUREMENTS**		20
	Year:	Course code:15ME33T		

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	III SEM	**MECHANICAL MEASUREMENTS**	20
	Year: 2015-16	Course code:15ME33T	

Name of Course coordinator :   Units:1, Co: 1,2,3.

Note: Answer all questions

Question no	Question	CL	CO	PO
1	Explain Systematic and Random Errors. 4 MARKS	U	1	1,2,3,4
2	Define i) Sensitivity, ii)Accuracy. iii)Calibration 3 MARKS	R	1	1,2,3,4
3	Draw a neat sketch of Bevel Protractor and labels its parts. OR Explain with neat sketch Taysurf surface roughness tester 7 MARKS	A	1	1,2,3,4,10
4	Explain with neat sketch measurement of thread by Bench micrometer. 6 MARKS	A	1	1,2,3,4,10

3- Semester Diploma Examination
Course Title: MECHANICAL MEASUREMENTS

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>SIX</u> from **Part A** and any <u>SEVEN</u> from Part B

Time: 3 hrs   **Max :100marks:100**

PART-A   6x5=30 marks

1. Define Measurement and mention its requirements.   05
2. List the advantages of Resistance thermometer.   05
3. List the various types of testing equipment's used for machine tool   05
    alignment test
4. Explain the calibration procedure for measuring instrument   05
5. Explain the mounting of strain gauge.   05
6. Differentiate Resistance thermometer and thermocouple.   05
7. Compare Hole Basis System with Shaft Basis System.   05
8. Explain with a neat sketch the working of Rotameter.   05
9. Explain with a neat sketch Diaphragm type pressure gauge

PART-B
10. a)List the various factors in selection of measuring instruments.   05

    b)Explain with neat sketch measurement of thread by Bench micrometer.   05
11. a)Explain Strain Gauge Rosettes.   05

    b)Sketch the schematic diagram of the following transducer   05
       actuating   mechanisms.

    i) Circular bourdon tube   ii)Straight tube.
12. a)List the advantages of Resistance thermometer.   05

    b).Classify the various of tachometers.   05
13. Explain with a neat sketch the working principle Mcloed gauge.   10
14. a)Explain with a neat sketch Hydrometer.   05

    b)Explain with neat sketch the working of Proving ring   05
15.Explain with a neat sketch Hole Basis System and Shaft Basis System.   10
16.a)Explain Uni-lateral and Bi-lateral tolerance.   05

    b)Write short notes on sphygmomanometer.   05
17.a)Predict the advantages and disadvantages of LVDT.   05

    b)Explain with neat sketch progressive plug gauge.   05
18.Sketch a neat block diagram of Optical strain gauge and label its parts.   10
19.a)Write the classification of Strain gauge.   05

    b)Briefly explain the various classification of transducers.   05

3rd Semester Diploma in Mechanical Engineering
Course title: Mechanical Measurements

CO-I Know the terms of the measurements, and Understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions

Remember

1.Define Measurement and mention its requirements.

2.Define a) Precision b)Repeatability.

3.Define a) Calibration. b)Threshold

4.Define a) Hysteresis.   b)Range

5.Define a)Sensitivity   b)Accuracy.

6.Define i) Sensitivity, ii)Accuracy. iii)Calibration

7.Define error and mention types of errors.

8. Name the various types of error.

9.List the various factors in selection of measuring instruments.

10.State the advantages of CMM.

11.State the types of error.

Understand

1.Explain the signification of measurement.

2.Explain the various methods of measurements.

3.Explain the calibration procedure for measuring instrument

4.Explain Systematic and Random Errors.

5.Explain the various methods of measurements with suitable examples.

6.Explain Taysurf surface roughness testor.

Application

1.Explain with neat sketch thread gauge micrometer.

2.Explain with neat sketch measurement of thread by Bench micrometer.

3.Explain with neat sketch Bevel Protractor.

4.Draw a neat sketch of Bevel Protractor and labels its parts.

5.Explain with neat sketch the use of sine bar.

6.Explain with neat sketch progressive plug gauge.

7.Explain with neat sketch plain plug gauge.

8.Explain with neat sketch snap gauge.

9.Explain with neat sketch Ring gauge.

10.Explain with neat sketch of CMM.

11.Explain with neat sketch thread gauge micrometer. And its uses.

12. Explain with neat sketch Taysurf surface roughness tester

13. Explain with neat sketch CMM.and its use.
14. Write short notes on CMM.

CO-2: Appreciate Measurement of strain by using a basic strain gauge and hence verify the stress induced and application of transducers in mechanical engineering applications for sustainable development

Remember
1. Define transducer, list the uses of transducer.
2. List out the major transducer characteristics.
3. List the various classifications of transducers. With examples.
4. List out the any five typical transducer actuating mechanisms.
5. State the various types of self-generating transducers.
6. List the various piezo-electric materials that exhibit piezoelectric effect.
7. Define strain gauge and list its purposes
8. State the advantages and limitation of mechanical strain gauge..
9. State the various transducers selection factors.
10. List any four transducer characteristics
11. List the various classification of transducers with examples on each.
12. State the various typical transducer actuating mechanisms.
13. Name any four type of self-generating Analog transducers.
14. State various transducer characteristics
15. List the various piezo-electric materials.
16. Define gauge factor

Understanding
1. Explain the concept of variable and current generating analog transducers.
2. Explain the mounting of strain gauge.
3. Explain gauge factor.
4. Explain Strain Gauge Rosettes.
5. Explain briefly the working of optical strain gauge.
6. Explain the concept of variable and current generating analog
    transducers and mention its types.
7. Classify the Strain gauges.
8. Briefly explain the various classification of transducers.

Application
1. Explain with a neat sketch piezoelectric transducer.
2. Write the various transducers selection factors.
3. Sketch the schematic diagram of the following transducer actuating mechanisms.
    i)Corrugated diaphragm   ii)Bellows.
4. Sketch the schematic diagram of the following transducer actuating mechanisms.
    i) Capsule   ii) Twisted bourdon tube,
 5. Sketch the schematic diagram of the following transducer actuating mechanisms.
     i) Circular bourdon tube   ii)Straight tube.
6. Write the advantages and limitation of mechanical strain gauge..
7. Write short notes on gauge factor.
8. Write short notes on Strain Gauge Rosettes.
9. Explain with a neat sketch two element Rosette gauge.
10. Explain with a neat sketch three element Rosette gauge.
11. Sketch a neat block diagram of Optical strain gauge and label its parts.

12. Write various transducer characteristics
13. Explain with neat sketch Berry type strain gauge.
14. Explain with neat sketch piezoelectric transducer.
15. Write short notes on gauge factor.
16. Explain with a neat sketch the working principle of Optical strain gauge.
17. Write the classification of Strain gauge.

CO-3: Apply the principles of instrumentation for transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress in mechanical engineering applications for sustainable development

Remember
1. Define force and List any three force measuring instruments.
2. Define is torque? What is the reason for measuring it.
3. Discribe dynamometer and list its applications.
4. Define pressure. List the pressure measuring instruments.
5. Define force and List any three force measuring instruments.
6. State the principle of thermocouple.
7. List the advantages of Resistance thermometer.
8. List the types of mechanical tachometers.

Understanding
1. Explain the working of Proving ring and its use.
2. Explain the principle working Optical pyrometer.
3. Classify tachometer.
4. Explain the working principle of thermocouple.
5. Explain Resistance thermometer.
6. Differenciate Resistance thermometer and thermocouple.
7. Describe tachometer and Mention types of mechanical tachometers.
8. Classify the various types of tachometers.
9. Predict the advantages and disadvantages of LVDT.
10. Express the advantages and disadvantages of the Rotameter.
11. Express the advantages of Resistance thermometer.
12. Identify the advantages and Disadvantages of the Resistance thermometer.
13. Distinguish between thermocouple and Resistance thermometer.
14. Explain thermocouple and mention any three commonly used thermocouple material.
15. Classify the various of tachometers.
16. Identify the advantages and disadvantages of LVDT.
17. Indicate the advantages of Resistance thermometer
18. Identify the advantages and disadvantages of the Rotameter.
19.. Explain phenomena of piezo-electric effect.

Application
1. Explain with neat sketch Spring Balance.
2. Sketch and Explain the instrument commonly used for measurement of heavy loads in Industries.
3. Explain with a neat sketch the working of Hydraulic Dynamometer
4. Explain with neat sketch the construction and working of Proving ring.

5. Explain with a neat sketch working of Strain gauge type load cell..
6. Explain with neat sketch the working of Proving ring
7. Explain with neat sketch Prony Brake Dynamometer.
8. Explain with a neat sketch Diaphragm type pressure gauge.
9. Explain with neat sketch the working of Bourdon tube pressure gauge.
10. Explain with a neat sketch the working principle Mcloed gauge.
11. Explain with a neat sketch the working principle of Mcloed gauge and its use.
12. Explain with a neat sketch the working of Revolution counter.
13. Explain with a neat sketch the working of Eddy current tachometer.
14. Explain with a neat sketch of LVDT.
15. Explain with a neat sketch the working of Rotameter.
16. Write the advantages and disadvantages of the Rotameter.
17. Write the advantages of Resistance thermometer.
18. Explain with a neat sketch Resistance thermometer.
19. Write the advantages and Disadvantages of the Resistance thermometer.
20. Explain with neat sketch Optical pyrometer.
21 Explain with a neat sketch, the principle working of thermocouples.
22. Explain with a neat sketch of LVDT and show its characteristics.
23. With a neat sketch Explain the principle working of thermocouples.

CO-4: Apply the principles of miscellaneous measurements for humidity, density, level and blood pressure.

Understanding
1. Explain measurement of blood pressure using sphygmomanometer.
2. Explain the terms a)Humidity   b)Density

Applications
1. Explain the working of hair hygrometer with a neat sketch.
2. Explain with a neat sketch Hydrometer.
3. Explain with a neat sketch liquid level measurement by using sight glass.
4. Explain with a neat sketch the principle of float gauge for liquid level measurement .
5. Explain with sketch measurement of blood pressure using sphygmomanometer.
6. Write short notes on sphygmomanometer.

CO-5: Apply the principles of limits, fits, tolerance and Analyse the process alignment testing of machine tools for manufacturing field.

Remember
1. Define the following terms
   a)Limit   b)Allowance
2. Define the following terms
    a)Basic Size   b)Tolerance
3. Define the following terms
   a)Zero line   b)Fit
4. Define the following terms
   a)Deviation   b)Actual size
5. a)Define the following terms

i)Limit   ii)Allowance   iii)Basic size

6. Define tolerance and briefly explain its types.

7..Define deviation and explain types of deviation.

8.Define fit and mention its types of fits.

9. List the various types of testing equipment's used for machine tool
   Alignment test.

10. Define Interchangeability. State its importance.

   11.   Quote the reason for adopting hole basis system as the standard practice.

Understanding

1.Distinguish Hole Basis System and Shaft Basis System.

2.Explain Uni-lateral and Bi-lateral tolerance.

3.Differenciate between unilateral and Bilateral tolerance.

4.Express the reason for adopting hole basis system as the standard practice.

5.Explain the importance of Geometric test on machine tools.

6.Compare Hole Basis System with Shaft Basis System.
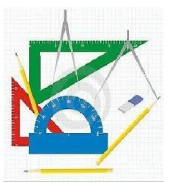
Applications

1.Explain with neat sketch clearance fit.

2. Explain with neat sketch interference fit.

3. Explain with neat sketch transition fit.

4. Explain with a neat sketch Hole Basis System and Shaft Basis System.

5.Write the reason for adopting hole basis system as the standard practice.

6.Write short note on Interchangeability.

7.Write short note on selective assembly.

8.Explain with neat sketch interference fit.

9.Write a neat sketch of Graphical illustration of limits and tolerances.

10.Explain with neat sketch he procedure for checking the parallelism of spindle axis to carriage movement in lathe.

11..Explain with neat sketch the procedure for checking the straightness of the carriage movement in lathe.

12..Explain with neat sketch checking of run out of axis of centre in lathe.

13.With neat sketch explain shaft basis system.

14.With neat sketch explain Hole Basis system.

.

Prerequisites: Engineering graphics-I and Engineering graphics-II and Sound pictorial

	Course Title: **MACHINE DRAWING**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME34D**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Course Objectives:

1. Understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of production and assembly drawings.
2. This course envisages reinforcing and enhancing the knowledge and skill acquired in the earlier two courses

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Interpret Conventional symbols as per IS code SP46.	**R**	1,2,3,10	**04**
CO2	Understand the Conventional methods of representing threaded fasteners	**R**	1,2,3,10	**12**
CO3	Understand the Conventional representation of Riveted joints	**U/A**	1,2,3,10	**12**
CO4	Categorize attributes of Production Drawing and Limits, fits, tolerances	U	1,2,3,10	**06**
C05	Illustrate the significance & use of tolerances of size, forms & positions	*U*	1,2,3,10	**06**
C06	Visualize the assembly of a given set of details of machine components	*U/A*	1,2,3,8,9,10	**38**
		Total sessions		**78**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE DRAWING	**03**	**03**	**03**	-	-	-	-	**2**	**2**	**3**
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3 If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2 If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1 If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	CONVENTIONAL REPRESENTATION	04	15	--	---	15	11.5
2	THREADED FASTENERS	12	---	--	15	15	11.5
3	RIVETED JOINTS	12	--	---	15	15	11.5
4	LIMITS, FITS AND TOLERANCES	06	---	15	--	15	11.5
5	PRODUCTION DRAWINGS	06	--	---	---	---	------
6	DETAILS TO ASSEMBLY	38	--	---	70(*)	70(*)	54
	Total	78	15	15	100	130	100

Legend: R; Remember, U: Understand A: Application

(*): Compulsory question to be answered

UNITI: CONVENTIONAL REPRESENTATION   04Hrs

Standard convention using SP – 46 (1988)-Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber-Long and short break in pipe, rod and shaft.- Various sections- Half, removed,-Standard convention of Knurling, splined shafts, and chain wheels-Springs with square and flat ends, Gears, sprocket wheel-Countersunk &counter bore

UNTII: THREADED FASTENERS   12Hrs

Screw thread terminology-Conventional representation of External threads and internal threads-Draw the top and front view of hexagonal headed bolt with nut across flat and corner-Draw -square headed bolt across corner and flat-cylindrical headed bolt-Eye bolt-Locking devices-Draw the views of for standard dimensions-lock nut-castle nut-Studs-Tap bolt-Machine screws-washers-Keys-sunk key-Gib head key.(For a given standard diameter with proportions)

UNITIII: RIVETED JOINTS   12Hrs

Rivets-types-Types of riveted joints-Draw the sectional front view and top view of-single riveted lap joint, double riveted lap joint with chain riveting and zigzag riveting. Draw the sectional front view and top view of-single riveted butt joint with single and double cover plate - double riveted butt joint with chain riveting and zigzag riveting with double cover plate.

UNIT IV: LIMITS, FITS AND TOLERANCES   06Hrs

Concept of limits, fits & allowances--Introduction to ISO system of tolerance,-dimensional tolerances-Draw the working drawing plain step turned shaft of varying diameter, indicate the dimensional tolerances

UNIT V: PRODUCTION DRAWINGS   06Hr

Surface roughness-Indication of machining-symbol showing direction of lay, roughness grades, machining allowances, Machining symbols used in industry
(Suggested Practice:Disassembling of any Physical model having not less than five parts, sketch the minimum views required for each component, measure all the required dimensions of each component.)

UNIT VI: DETAILS TO ASSEMBLY   38Hrs

Introduction to the unit assembly drawing, steps involved in preparing assembly drawing from Details-Sequence in assembly-Preparation of details and Assembly of parts with Sectional views of- **Socket and Spigot joint Cotter Joint-- Knuckle joint- Protected Flanged coupling- Universal coupling-Plummer Block and Screw Jack (Front, side and top views)**

TEXT BOOKS

    1. Machine drawing, -K.R. Gopala Krishna Subhas Publishers, Bangalore

REFERENCES
1. Machine Drawing**-** N.D.Bhatt, Charotar Publication, Anand
2. Machine Drawing-Sidheshwar-Tata McGraw Hill
3. Code of practice for general engineering-IS Code SP 46(1988)- Engineering Drawing Practice for School and colleges
4. Production Drawing-L.K.Narayanan,P.Kannaich,- New Age International Publication

SUGGESTED LIST OF STUDENT ACTIVITYS
Note: the following activities related to unit 5 and for assessing CIE(IA)
1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Select at least four simple mechanical components each made up of minimum 5-6 Manufacturing operations. Get them approved by teacher. Measure and sketch them in a drawing sheet with dimensions.
2	Select at least one simple mechanical assembly in group of 5-6 students, each made up of minimum 5-6 manufacturing operations. Get them approved by teacher. Measure and sketch them in a drawing sheet with dimensions. Example- assembly of any coupling, carburetor, machine vice, fuel pump, tail stock etc.
3	Bring Actual assembly from workshop/industry, measure dimensions, sketch it and make 2D production drawing for the same.

Course Delivery:
The course will be delivered through lectures and Demonstration and practices

NOTE:.
1. Students should use two separate A3 size sketchbooks, one for class work and another for assignment.
2. Students should solve assignment on each topic. The sessional marks will be awarded on the basis of Graded exercises and assignment
3. Use half imperial size drawing sheet for term work

MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

<table>
<tr><th></th><th colspan="2">What</th><th>To whom</th><th>When/Where (Frequency in the course)</th><th>Max Marks</th><th>Evidence collected</th><th>Course outcomes</th></tr>
<tr><td rowspan="3">Direct Assessment method</td><td>CIE</td><td>IA</td><td rowspan="3">Students</td><td>Graded Exercises- Average marks all graded exercises to be computed.</td><td>20</td><td>Drawing Sheets</td><td>1.2,3,4,5,6</td></tr>
<tr><td rowspan="2">SEE End Exam</td><td></td><td>Student activities</td><td>05</td><td>Log of activity</td><td>1.2,3,4,5,6</td></tr>
<tr><td></td><td>End of the course</td><td>100</td><td>Answer scripts at BTE</td><td>1.2,3,4,5,6</td></tr>
<tr><td rowspan="2">Indirect Assessment</td><td colspan="2">Student Feedback on course</td><td rowspan="2">Students</td><td>Middle of the course</td><td></td><td>Feedback forms</td><td>1, 2,3 Delivery of course</td></tr>
<tr><td colspan="2">End of Course Survey</td><td>End of the course</td><td></td><td>Questionnaires</td><td>1,2,3,4,5,6- Effectiveness of Delivery of instructions & Assessment Methods</td></tr>
</table>

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Drawing sheet files (Two /Three students)(20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

NOTE:THIS SUBJECT SHOULD THOUGHT IN A BATCH OF 15 TO 20 STUDENTS,TEACHER INCHARGE PER BATCH HAS TO MONITER, EVALUATE OR ASSESS THE STUDENTS.

III Semester Diploma in Mechanical Engineering
MACHINE DRAWING

Time: 4 **Hours**   [Max Marks**: 100]**

Note: Answer any ONE from **Part A** and **Part B, Part-C** is compulsory

Part A

1.a) Draw the conventional representation of the following materials.   -9M
i)) Wood   (ii) steel (iii) rubber
   b) Draw the conventional representation of the following sections.
      (i) Bottom-half in section (ii)Right - half in section   -6M
2.Draw the diagrammatic representation of the following   -15M
 (i)Clearance fit (ii) Interference fit (iii) Transition fit

Part B

2. Draw the front and top view of ISO threaded Square bolt and Nut of 100 mm   long with a threaded   length of   50mm. The diameter of the bolt is 20 mm across corner-15M

3.Draw to 1:1 scale the sectional front view and top view of a single riveted Butt joint with double cover plate. The thickness of the plate is 9 mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.   -15M

Part C

1. The detail parts of a SCREW JACK is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing

      (i)Front view in section   -45M
      (ii) Top view   - 25M
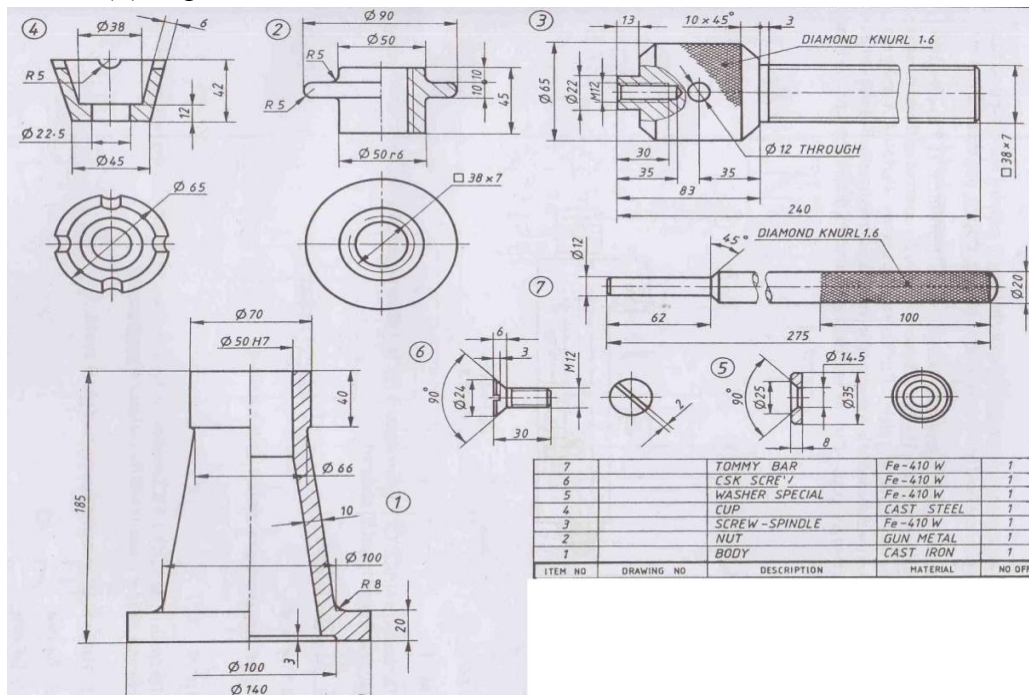
III Semester Diploma in Mechanical Engineering
MACHINE DRAWING
(15 MARKS QUESTIONS)
PART-A & PART-B

CO 01: INTERPRET CONVENTIONAL SYMBOLS AS PER IS CODE SP46.

LEVEL:REMEMBER

1.a) Draw the conventional representation of the following materials.   -9M
i) Lead (ii)Glass (iii) fibre
b)Draw the conventional representation of the following sections.
(i) Top-half in section (iv)Left - half in section-6M

2.a) Draw the conventional representation of the following materials.   -9M
i)) Wood   (ii)steel (iii) rubber
   b) Draw the conventional representation of the following sections.
      (i) bottom-half in section (ii)Right - half in section   -6M

3. a) Draw the conventional representation of the following materials.   -9M
i)) Cast iron   (ii)plywood (iii) rubber
   b) Draw the conventional representation of the following sections.
      (i) Top-half in section (ii)Right - half in section   -6M

4.Draw the conventional representation of the following sections.
   a) (i) Knurling operation (ii) splined shafts and -Springs with square and flat ends
 (iii) chain wheels -9M
 b) Draw the conventional representation of the following sections.
      (i) Top-half in section (ii)Right - half in section   -6M
5.Draw the conventional representation of the following sections.
a)(i)Knurling operation(ii)Counter sunk & counter bore(iii)Spur gear -9M
   b) Draw the conventional representation of the following sections.
      (i) Top-half in section (ii)Right - half in section   -6M

CO 02: UNDERSTAND THE CONVENTIONAL METHODS OF REPRESENTING THREADED FASTENERS

LEVEL:APPLICATION

1.Draw the front and top view of ISO threaded Hexagonal bolt and Nut of 120 mm long with a threaded length of 60 mm. The diameter of the bolt is 24mm across corner.

2.Draw the front and top view of ISO threaded Hexagonal bolt and Nut of 100 mm long with a threaded length of   50mm. The diameter of the bolt is 20 mm across Flat

3.Draw the front and top view of ISO threaded Square bolt and Nut of 100 mm long with a threaded   length of   50mm. The diameter of the bolt is 20 mm across Flat

4. Draw the front and top view of ISO threaded Square bolt and Nut of 100 mm long with a threaded   length of   50mm. The diameter of the bolt is 20 mm across corner

5. Draw the front and side view of a lifting Eye bolt of diameter 24mm and indicate all the proportions.

6.Draw the front and Top view of a split pin method of locking of an ordinary Nut   of diameter 24mm and indicate all the proportions.

CO 03: UNDERSTAND THE CONVENTIONAL REPRESENTATION OF RIVETED JOINTS

LEVEL:APPLICATION

 1.Draw to 1:1 scale the sectional front view and top view of a double riveted lap joint with chain riveting .The thickness of the plate is 10mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

1. Draw to 1:1 scale the sectional front view and top view of a double riveted lap joint with Zig-zag riveting .The thickness of the plate is 10mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

2. Draw to 1:1 scale the sectional front view and top view of a single riveted Butt joint with double cover plate. The thickness of the plate is 9 mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

4.Draw to 1:2 scale the sectional front view and top view of a single riveted Butt joint. The thickness of the plate is 20 mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

5.Draw to 1:1 scale the sectional front view and top view of a double riveted Butt joint with double cover plate with change riveting. The thickness of the plate is 12mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

6.Draw to 1:1 scale the sectional front view and top view of a double riveted Butt joint with double cover plate with change Zig-zag riveting. The thickness of the plate is 12 mm. Use snap head rivets and show at least three rivets. Indicate all the dimensions.

CO 04:CATEGORIZE ATTRIBUTES OF PRODUCTION DRAWING AND LIMITS,FITS,TOLERANCES

LEVEL:UNDERSTANDING

1.Draw the diagrammatic representation of the following   -15M
  (i)Clearance fit (ii) Interference fit (iii) Transition fit

2.   a)Draw the designation of shaft of basic size 20mm of grade 8 with upper deviation   zero   --7M
b)Dimension a hole of base size 30mm grade 7 with lower deviation zero by using letters and numerals on a sketch.   –8M

Part B
(70 MARKS QUESTION WHICH IS COMPULSORY)
(*FOR END EXAM ANY TWO VIEWS TO BE ASKED*)

CO 06:VISUALIZE THE ASSEMBLY OF A GIVEN SET OF DETAILS OF MACHINE COMPONENTS

LEVEL:APPLICATION

1.The detail parts of a SOCKET AND SPIGOT JOINT COTTER JOINT is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing

  (i)Front view with Top-half in section.
  (ii) Top view
  (iii)Right view

Details of Socket and Spigot Cotter Joint
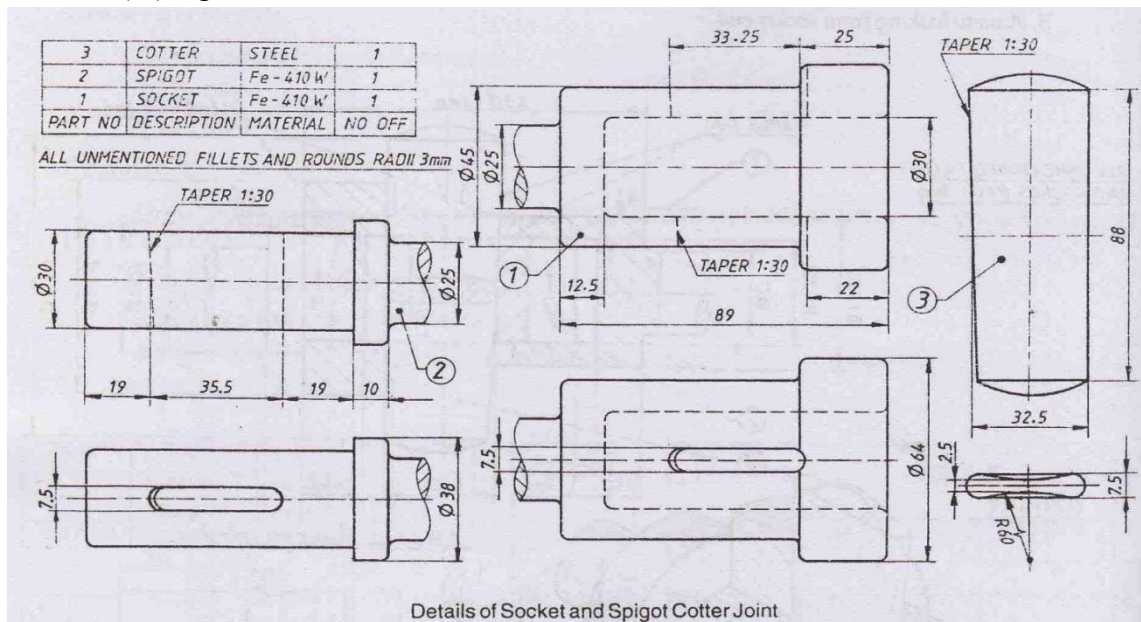
2.The detail parts of a KNUCKLE JOINT is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing

  (i)Front view in section
  (ii) Top view
  (iii)Left view

5	TAPER PIN	Fe-410W	1
4	COLLAR	Fe-410W	1
3	PIN	Fe-410W	1
2	EYE	Fe-410W	1
1	FORK	Fe-410W	1
PART NO	DESCRIPTION	MATERIAL	NO OFF

ALL UNMENTIONED FILLETS AND ROUNDS RADII 3mm
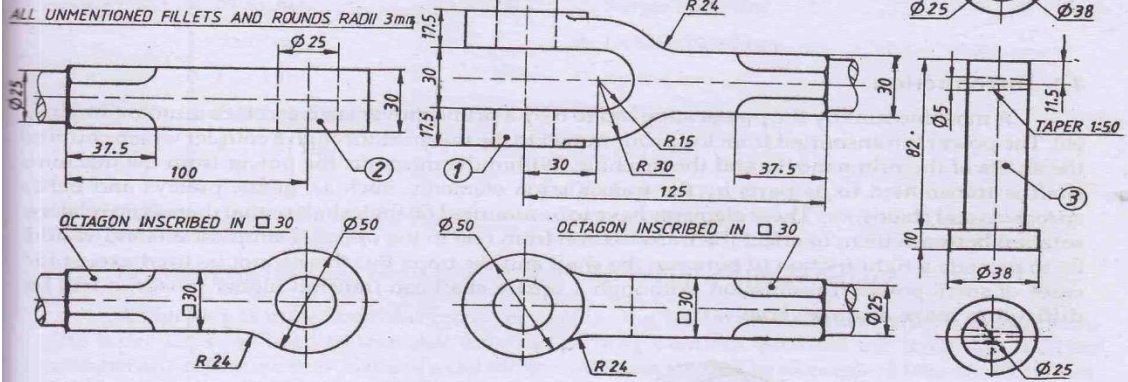
Details of a Knuckle Joint

3. The detail parts of a PROTECTED TYPE FLANGED COUPLING is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing
(i)Front with Top-half in section
(ii) Top view
(iii)Left side view

6	HEX. NUT	Fe-410 W	4
5	HEX. BOLT	Fe-410 W	4
4	TAPER KEY	Fe-410 W	2
3	SHAFT	Fe-410 W	2
2	FLANGE NO. 2	CI	1
1	FLANGE NO. 1	CI	1
PART NO.	DESCRIPTION	MATERIAL	NO. OFF

All Dimensions in mm
Details of Flanged Coupling — Protected Type
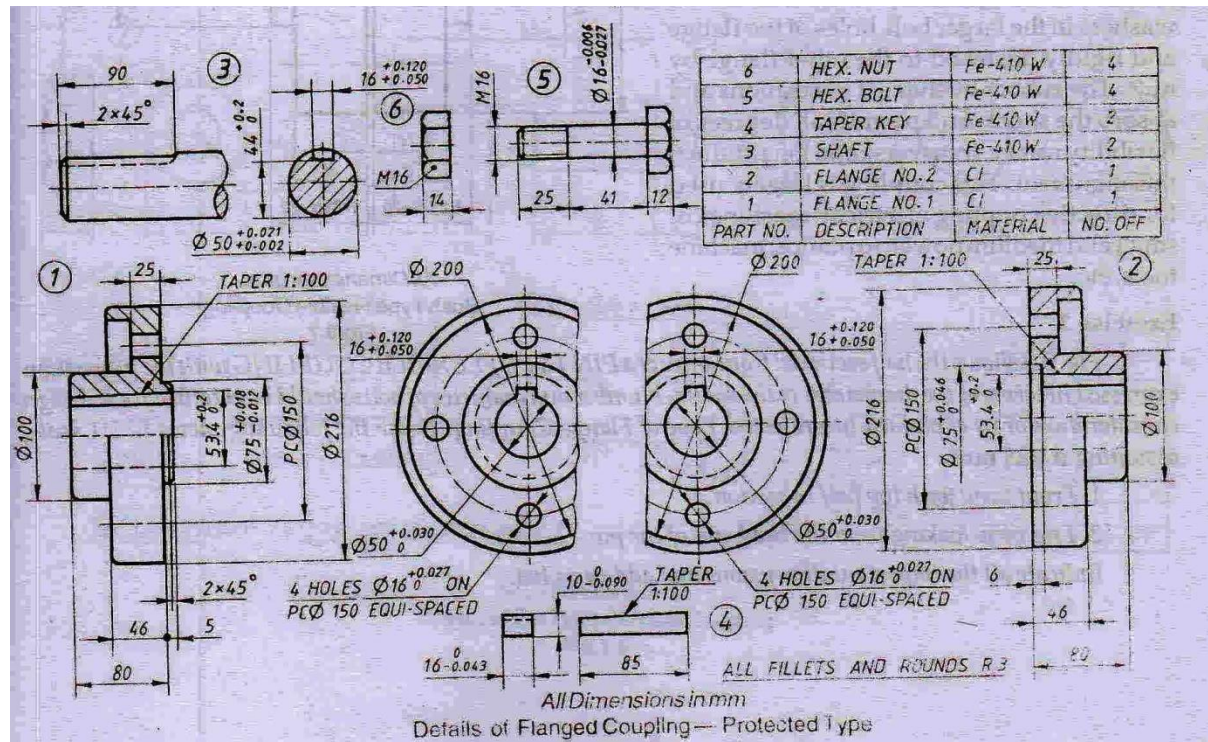
4. The detail parts of a UNIVERSAL COUPLING is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing
(i)Front view
(ii) Top view
(iii)Left side view

All Dimensions in mm
Details of Universal Coupling
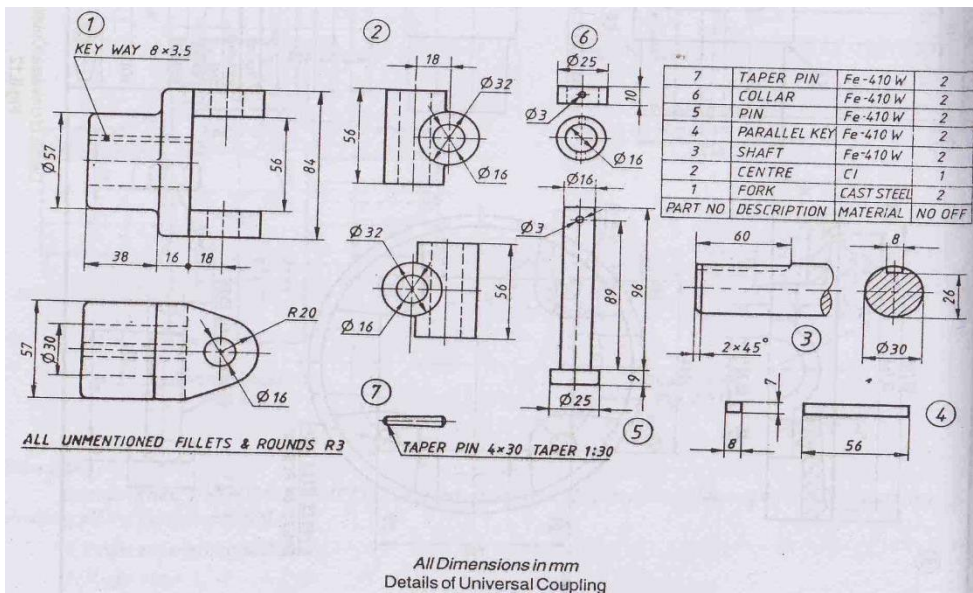
5. The detail parts of a PLUMMER BLOCK is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing
 (i) Front view with Right half in section
 (ii) Top view
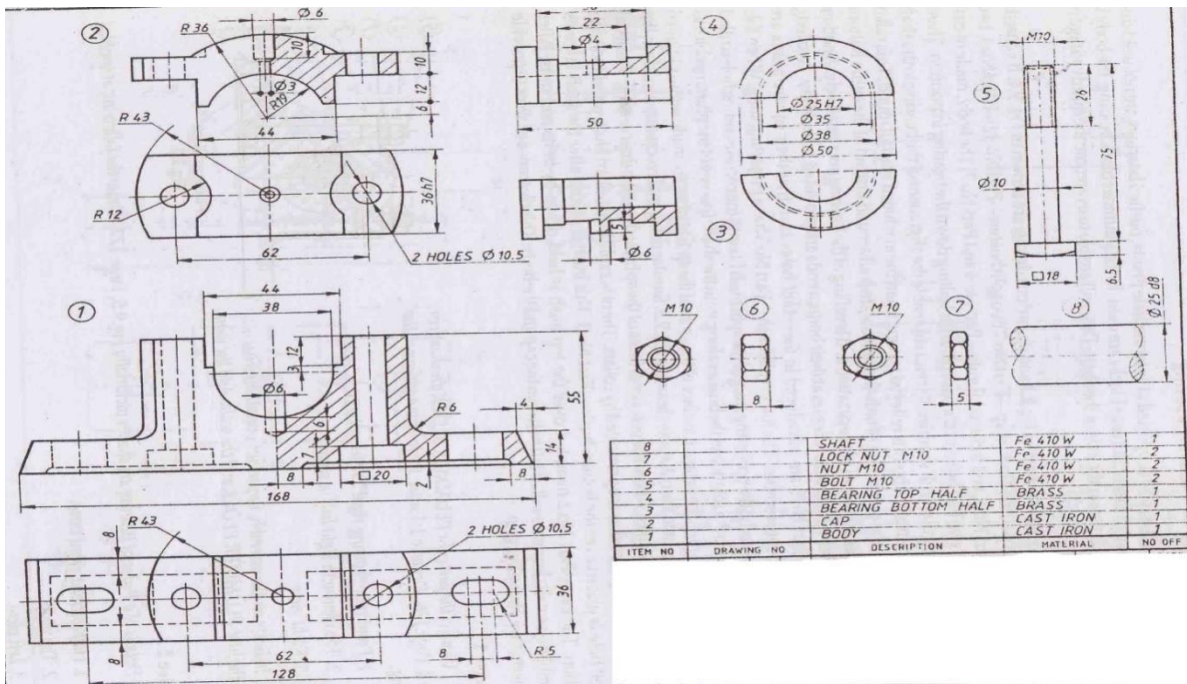
6. The detail parts of a **SCREW JACK** is given, Assemble the parts and show the following views to 1:1 scale. Show the important dimensions on the assembly Drawing
 (i) Front view in section
 (ii) Top view
(iii) Side view

Parts detail drawings with dimensions:

- ④ Ø38, 6, R5, R5, Ø22·5, Ø45, 12, 42, Ø65
- ② Ø90, Ø50, R5, R5, Ø50 r6, 10, 10, 45, □ 38 × 7
- ③ 13, 10 × 45°, 3, DIAMOND KNURL 1·6, Ø65, Ø22, M12, Ø12 THROUGH, 30, 35, 35, 83, 240, □ 38 × 7
- ⑦ Ø12, 45°, DIAMOND KNURL 1.6, 62, 275, 100, Ø20
- ① Ø70, Ø50 H7, 40, Ø66, 10, Ø100, R8, 185, 20, Ø100, 3, Ø140
- ⑥ 6, 3, 90°, Ø74, M12, 30
- ⑤ Ø12, 2, 90°, Ø25, Ø14·5, Ø35, 8

ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF
7		TOMMY BAR	Fe – 410 W	1
6		CSK SCREW	Fe – 410 W	1
5		WASHER SPECIAL	Fe – 410 W	1
4		CUP	CAST STEEL	1
3		SCREW – SPINDLE	Fe – 410 W	1
2		NUT	GUN METAL	1
1		BODY	CAST IRON	1

	Course Title: **MECHANICAL COMPUTER AIDED DRAFTING (MCAD)**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME35P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Basic computer Skills and Practice concepts of Machine drawing

Course Objectives:

1. Now a day a manual drafting is obsolete in industry. Computers being the inevitable part in an engineer's life due to its inbuilt characteristics which helps him to do various task with acceleration.
2. Using computers and CAD software it is easy to create and modify drawings ultimately it saves time. It also may be useful to generate assembly and manufacturing drawings.
3. In mechanical industry operating skills are required for computer aided drafting operations of machine components, handling of printers & plotters. This subject is also useful to apply concepts in 3 D modeling.

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked excises**	**Linked PO**	**Teaching Hrs**
CO1	Interpret and Draw, edit and modify 2D	U/A	Basics	1,2,3,9,10	**08**
CO2	Give dimensions, tolerances and geometrical tolerances	U/A	Basic commands	1,2,3,9,10	**08**
CO3	Create Isometric 2D Views and 3D drawing ,when orthographic views of simple machine parts/Threaded fasteners /Riveted Joints	U/A	Models from question bank (Sl.no 01 to 16)	1,2,3,9,10	**18**
CO4	Plot Assembly 2D drawings and Create their respective 3D Assembled views	U/A	Part drawings from question bank (Sl.no 01 to 05)	1,2,3,9,10	**44**
				Total sessions	**78**

Legend: U- Understand   A- Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL COMPUTER AIDED DRAFTING (MCAD)	**03**	**03**	**03**	-	-	-	-	-	**03**	**03**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT

Unit No	Unit Name	Hour	Questions to be set for (10marks) PART - A	Questions to be set for (40marks) PART - B	Marks weightage (%)
1	**CAD COMMANDS FAMILIARIZATION**	**08**	-----	------	-
2	**PRACTICE ON COMMANDS**	**08**	**01**	----	**17**
3	**CREATION OF 3D MODELS /THREADED FASTENERS/ RIVETED JOINTS**	**18**	**01**	-----	**17**
4	**DETAILS TO ASSEMBLY**	**44**	----	**01(*)**	**66**
	Total	**78**	**02**	**01**	**100**

Note: (*): Compulsory Question to be asked in end exam

UNITI: CAD COMMANDS FAMILIARIZATION   08Hrs

Introduction to MCAD(parametric modelling) software-Understanding parametric modelling technique, knowing the software interface, co-ordinate systems supported- Planes and their creation, reference axis, Sketch, Profile, constraints-geometrical and dimensional, need for constraining, fully constrained, under constrained, over constrained.

UNTII: PRACTICE ON COMMANDS   08Hrs

Practice 2D and 3D drawing commands
Hands on Exercises.
   Create2DDrawing for the ISOMETRIC OBJECT given by selecting from model question bank
   Create   3D Drawings for the ORTHOGRAPHIC VIEWS given by selecting from model question bank

UNIT III: ASSEMBLY   MODELING   44Hrs

Know the assembly environment, setting the assembly environment, types of assembly design approach-bottom-up and top-down assembly. Creating assembly Editing and modifying assembly relationships -Creating exploded view of the assembly –Create 3DAssemblymodels of- **Socket and Spigot type Cotter Joint-Knuckle joint—Plummer Block- Screw Jack**

UNIT IV:MODELS BY USING EQUESTIONS   18Hrs

Hexagonal nut and bolt, Solid muff coupling and journal bearing

TEXT BOOKS

1. Sham Tickoo- Autocad: A Problem-Solving Approach Thomson Learning EMEA, Limited
2. Machine Drawing- K.R.Gopala Krishna Subhas Publications Bangalore
3. George Omura- Mastering Auto CAD BPB Publication
4. T Jeyapoovan- Engineering Graphics Using AutoCAD Vikas Publishing House Pvt. Ltd. Fifth Edition

REFERENCES

1. Machine Drawing- N.D.Bhatt, Charotar Publication, Anand
2. Machine Drawing-Sidheshwar-Tata McGraw Hill
3. Code of practice for general engineering-IS Code SP 46(1988)- Engineering Drawing Practice for School and colleges
4. Production Drawing-L.K.Narayanan,P.Kannaich,- New Age International Publication

SUGGESTED LEARNING WEB SITES

http://www.we-r-here.com/cad/tutorials/index.htm
http://www.cadtutor.net/tutorials/autocad/
http://www.caddprimer.com/AutoCAD_training_tutorial/AutoCAD_training_lessons.htm
http://www.autocadmark.com/
http://www.autocadtutorials.net/

SUGGESTED LIST OF STUDENT ACTIVITYS

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Bring actual industrial production drawings from nearby industry and distribute them among group of students for self study and interpretation. Ask students to practice these drawings using any modeling software.
2	Bring small real components like Nut-Bolt, Washers, Cotter-knuckle Joints, Couplings, and Pulleys in the class. Ask students to use Vernier caliper to measure the dimensions and formulate relations between them. Practice same relations with AutoCAD/Pro-E software/Solid edge/catia to draw 2D/3D models of these components.
3	Take the students for industrial visit. Hands-on practice with drafting software to create a production drawing of an assembly.

The course will be delivered through lectures and Demonstration and CAD practices. This Lab can be performed using <u>ANY ONE</u> of the following software's:

1) Solid edge
2) Iron CAD
3) CATIA
4) ProE
5) Solid Works
6) INVENTOR
7) Any equivalent or open source software's

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment meth	CIE	IA	Students	Student activities	10	CAD drawing	1,2,3,4
				Record- Average marks of all graded exercises to be computed.	15	CAD exercises	1,2,3,4
	SEE	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4 Effectiveness of Delivery of instructions & Assessment Methods

***CIE** – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

<table>
<tr><th colspan="7">RUBRICS FOR ACTIVITY(10 Marks)</th></tr>
<tr>
<th rowspan="2">Dimension</th>
<th>Unsatisfactory</th>
<th>Developing</th>
<th>Satisfactory</th>
<th>Good</th>
<th>Exemplary</th>
<th rowspan="2">Student Score</th>
</tr>
<tr>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
<tr>
<td>Collection of data</td>
<td>Does not collect any information relating to the topic</td>
<td>Collects very limited information; some relate to the topic</td>
<td>Collect much information; but very limited relate to the topic</td>
<td>Collects some basic information; most refer to the topic</td>
<td>Collects a great deal of information; all refer to the topic</td>
<td>Ex:
4</td>
</tr>
<tr>
<td>Fulfil team's roles & duties</td>
<td>Does not perform any duties assigned to the team role</td>
<td>Performs very little duties but unreliable.</td>
<td>Performs very little duties</td>
<td>Performs nearly all duties</td>
<td>Performs all duties of assigned team roles</td>
<td>6</td>
</tr>
<tr>
<td>Shares work equally</td>
<td>Always relies on others to do the work</td>
<td>Rarely does the assigned work; often needs reminding</td>
<td>Usually does the assigned work; rarely needs reminding</td>
<td>Normally does the assigned work</td>
<td>Always does the assigned work without having to be reminded.</td>
<td>8</td>
</tr>
<tr>
<td>Listen to other Team mates</td>
<td>Is always talking; never allows anyone else to speak</td>
<td>Usually does most of the talking; rarely allows others to speak</td>
<td>Talks good; but never show interest in listening others</td>
<td>Listens, but sometimes talk too much</td>
<td>Listens and speaks a fair amount</td>
<td>8</td>
</tr>
<tr>
<td colspan="6" style="text-align:center">Average / Total marks=(4+6+8+8)/4=26/4=6.5=7</td>
<td></td>
</tr>
</table>

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	% Weightage
1	**Understanding**	**45**
2	**Applying the knowledge acquired from**	**40**
3	**Analysis**	**05**
4	**Evaluation& Creating new knowledge**	**10**

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Student suggested activities report for 10 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Scheme of Valuation for End Examination

Sl no	Questions	Marks

1	Create the model and drawing views(any 3) along with dimensions and annotations as per sketch given		10
	OR		
	Create the model and drawing views(any 3) along with dimensions and annotations using equations		10
2	Create the assembly model and drawing with dimension, BOM, - as per the given sketch**(*): Compulsory Question to be asked in end exam**		40
	Total		**50**

EQUIPMENT LIST:

1. Latest Configuration Computers which can be able to run latest any Computer Aided Drafting Software. (At least One Computer per student in practical session.)-20 no
2. Any latest Authorized Computer Aided Drafting Software (20 copies
3. Plotter of size A2/A3
4. LCD Projector

MODEL QUESTION PAPER
III Semester Diploma in Mechanical Engineering
MECHANICAL COMPUTER AIDED DRAFTING (MCAD)

Time: 3 **Hours**   [Max Marks**: 50]**

Note: Answer any ONE from **Part A** and **Part B** is compulsory

Part A

1.Create front , top and side view for the given 3D Drawing   -10M

OR

Create the 3D Part model for the given 2D Drawing-10M

Part B
1.Create3D Assembly models of a **PLUMMER BLOCK** for the given

detailparts.-40M

1. Create front , top and side view for the given 3D Drawing.

2.

3.

4.

5.

<u>6.</u>

7.

8.
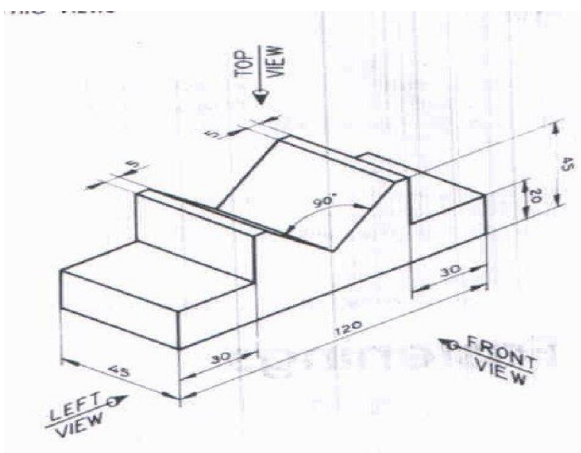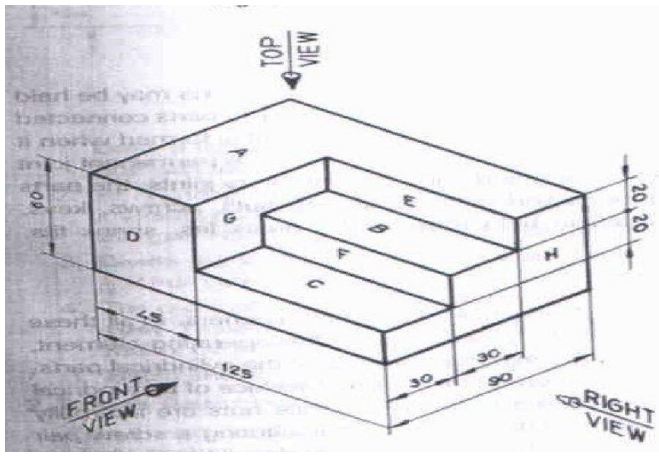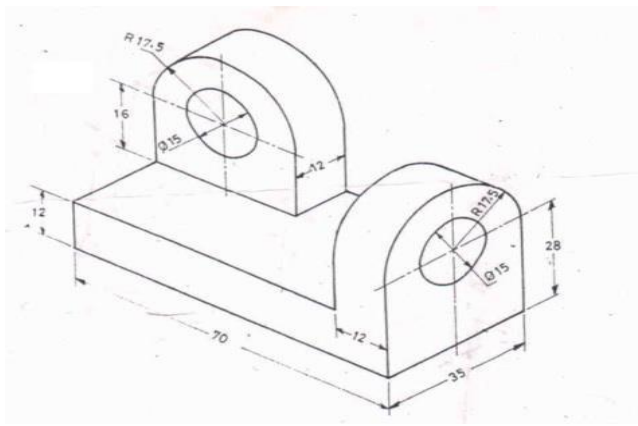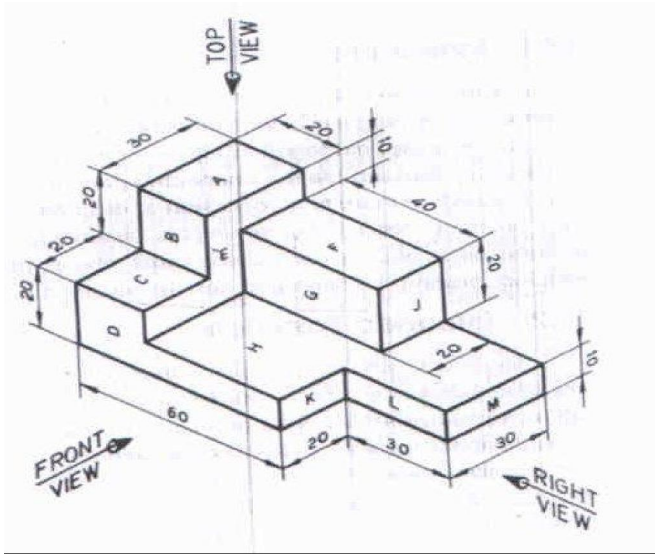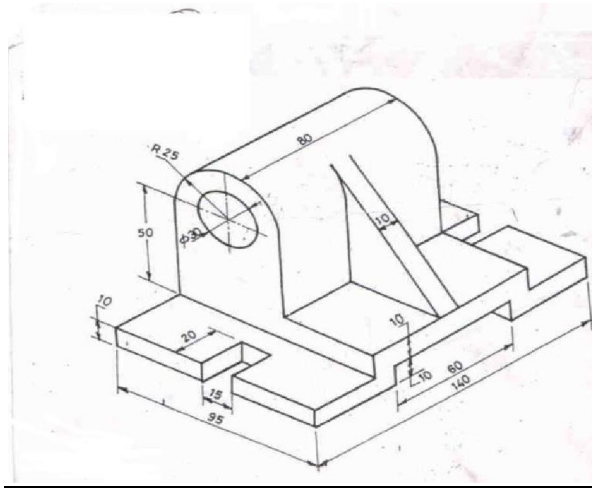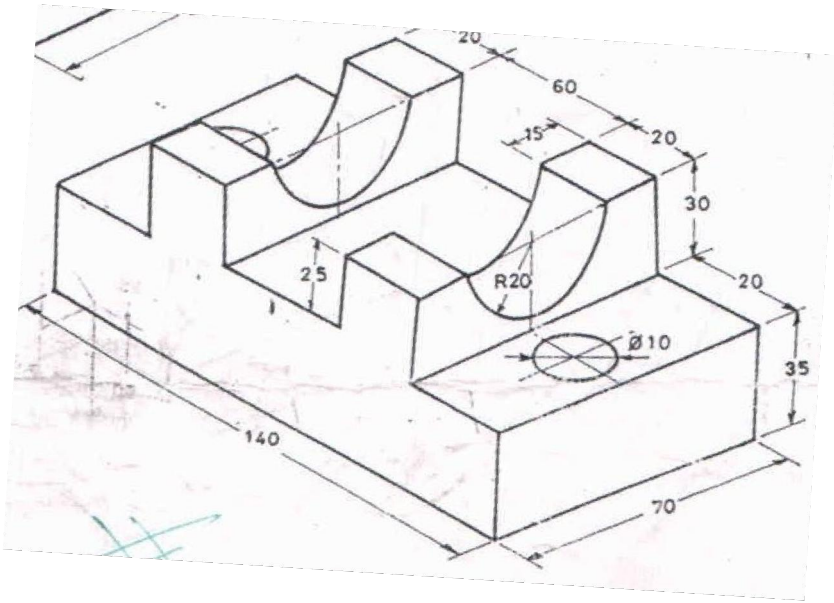
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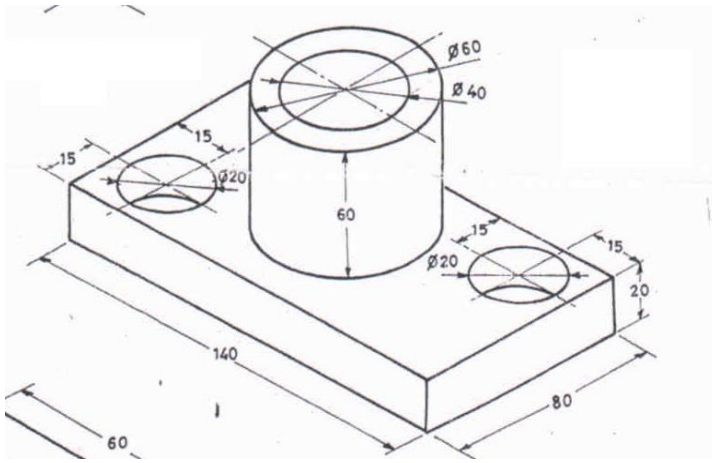
10.
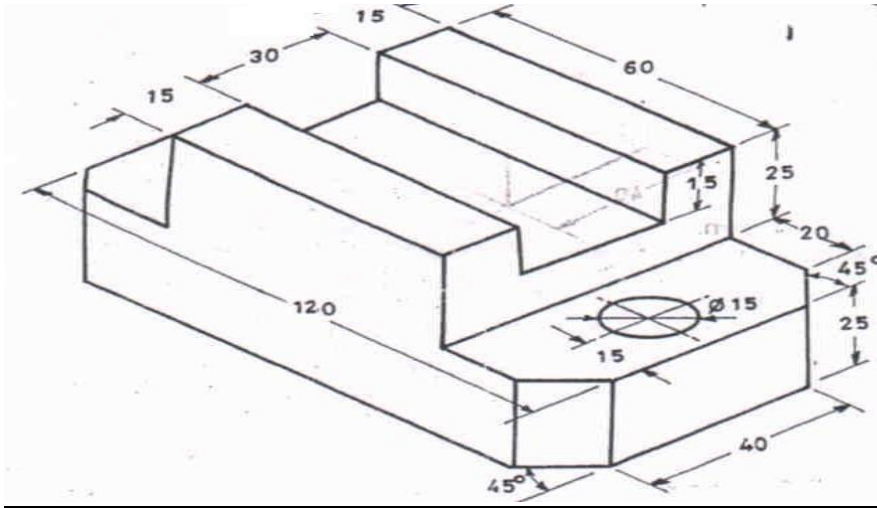
11. Create the 3D Part model for the given 2D Drawing

12.

13.

All dimensions in mm
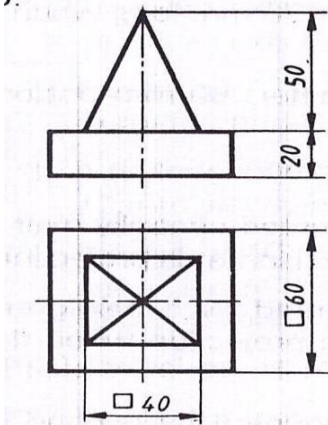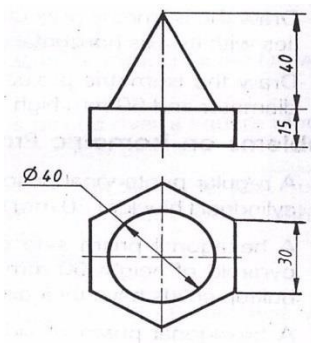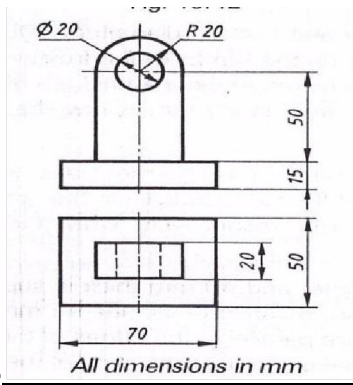
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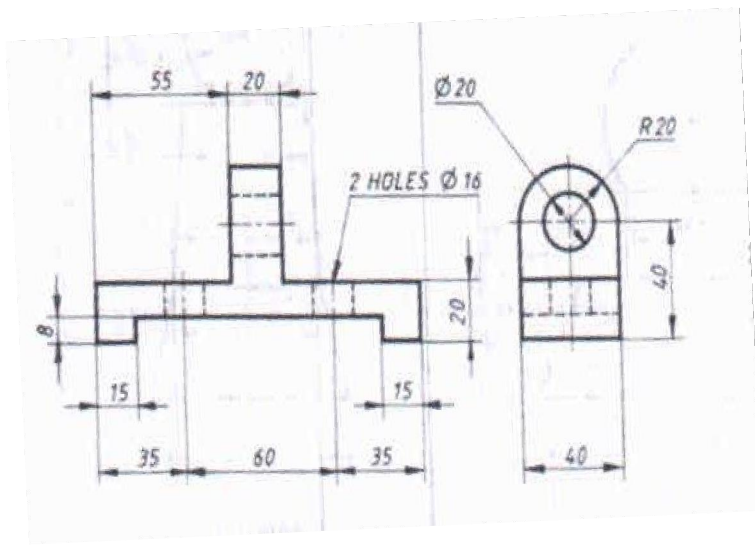
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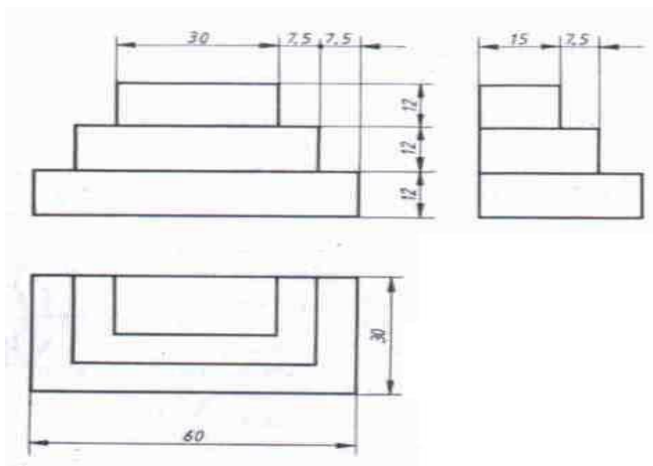
16.
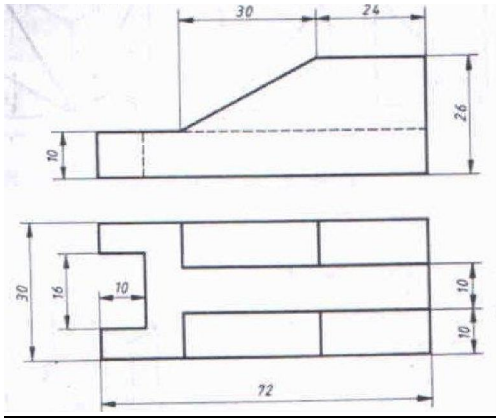
Part B

1. Create 3D Assembly models of a **SCREW JACK** for the given detail parts.

ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF
7		TOMMY BAR	Fe-410 W	1
6		CSK SCREW	Fe-410 W	1
5		WASHER SPECIAL	Fe-410 W	1
4		CUP	CAST STEEL	1
3		SCREW-SPINDLE	Fe-410 W	1
2		NUT	GUN METAL	1
1		BODY	CAST IRON	1

2. Create 3D Assembly models of a **PLUMMER BLOCK** for the given detail parts.

Details of a Knuckle Joint
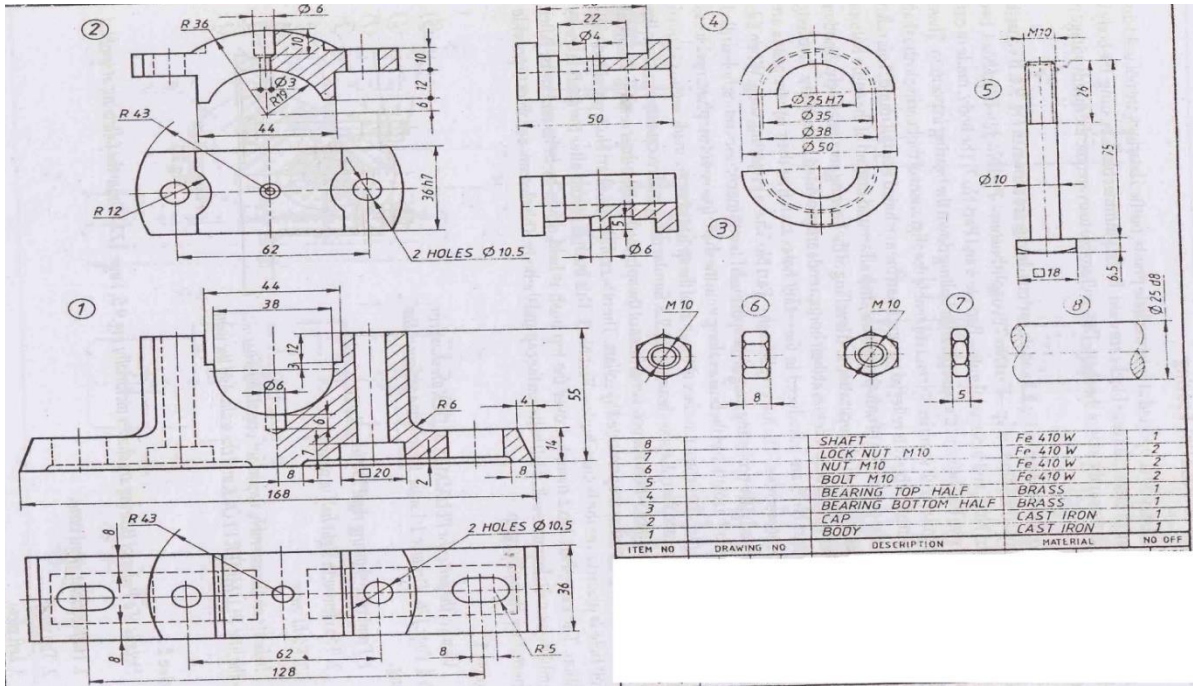
3. Create 3D Assembly models of **KNUCKLE JOINT** for the given detail parts.

8	SHAFT	Fe 410 W	1
7	LOCK NUT M10	Fe 410 W	2
6	NUT M10	Fe 410 W	2
5	BOLT M10	Fe 410 W	2
4	BEARING TOP HALF	BRASS	1
3	BEARING BOTTOM HALF	BRASS	1
2	CAP	CAST IRON	1
1	BODY	CAST IRON	1
ITEM NO	DRAWING NO	DESCRIPTION / MATERIAL	NO OFF

5	TAPER PIN	Fe-410W	1
4	COLLAR	Fe-410W	1
3	PIN	Fe-410W	1
2	EYE	Fe-410W	1
1	FORK	Fe-410W	1
PART NO	DESCRIPTION	MATERIAL	NO OFF

ALL UNMENTIONED FILLETS AND ROUNDS RADII 3mm
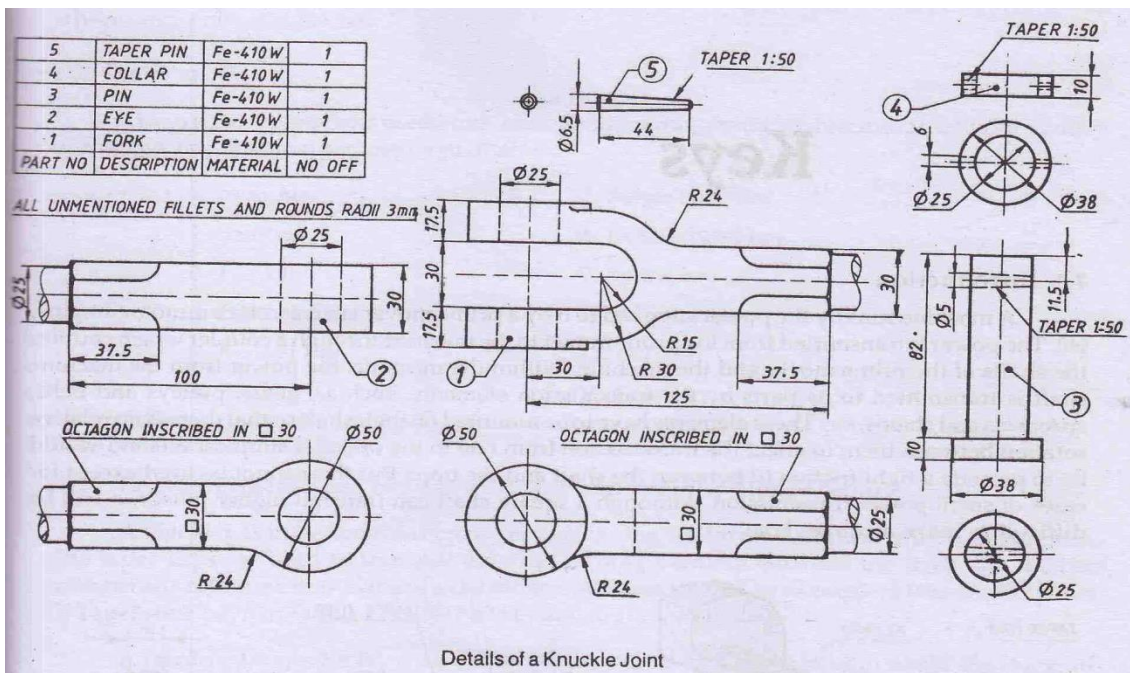
4. Create 3D Assembly models of a **SOCKET AND SPIGOT COTTER JOINT** for the given detail parts.

3	COTTER	STEEL	1
2	SPIGOT	Fe - 410 W	1
1	SOCKET	Fe - 410 W	1
PART NO	DESCRIPTION	MATERIAL	NO OFF

ALL UNMENTIONED FILLETS AND ROUNDS RADII 3mm

Details of Socket and Spigot Cotter Joint
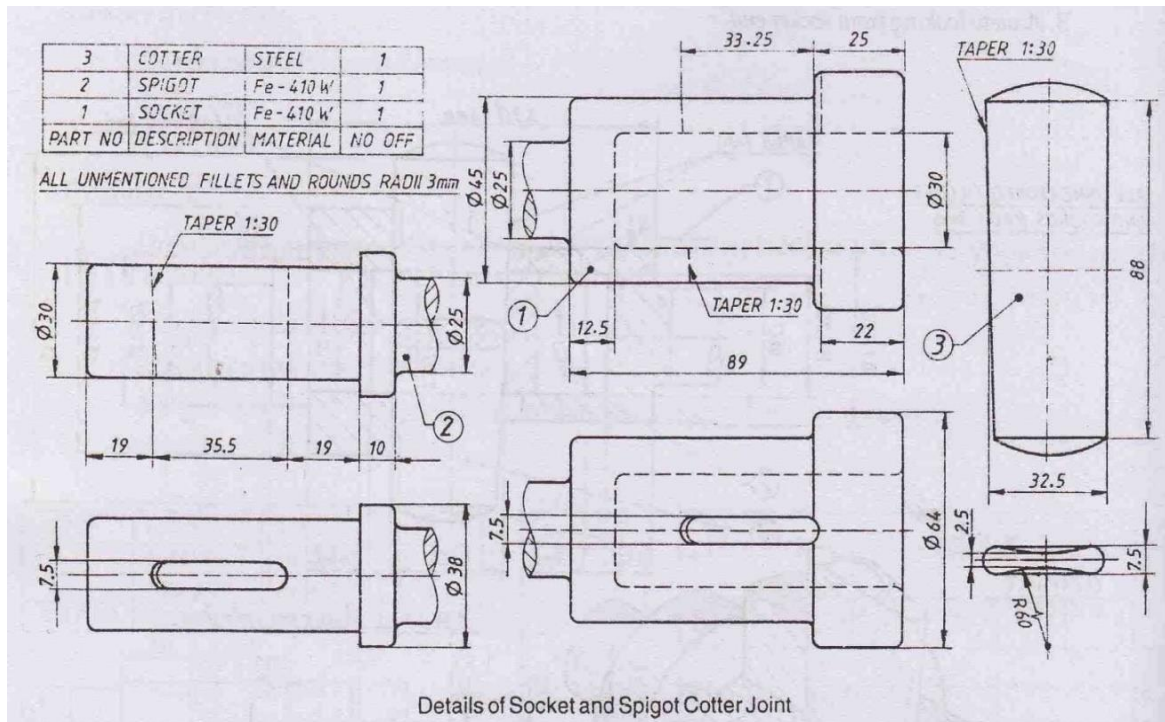
5. Create 3D Assembly models of a **BUSHED BEARING** for the given detail parts.

3		SHAFT	Fe 410 W	1
2		BUSH	BRASS	1
1		BLOCK	CAST IRON	1
ITEM NO	DRAWING NO	DESCRIPTION	MATERIAL	NO OFF

	Course Title: **BASIC WORK SHOP PRACTICE-II**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME36P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Theoretical concepts Work shop technology

Course Objectives:

1. To understand basic Metal shaping processes
2. To understand various Metal shaping operations and Procedure protocols.

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked practices**	**Linked PO**	**Teaching Hrs**
CO1	Acquire metal shaping process skill by Forging for a given job	*U/A*	ALL forging shop exercises	1,2,3,4,5,6 8,9,10	**26**
CO2	Prepare various sheet metals joint for required applications /Utility items	*U/A*	ALL sheet metal exercises	1,2,3,4,8,9, 10	**26**
CO3	Demonstrate and prepare various Foundry operations for required applications	*U/A*	ALL foundry exercises	1,2,3,4,5,6, 8,9,10	**26**
				Total sessions	**78**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
BASIC WORK SHOP PRACTICE-II	**03**	**03**	**03**	**03**	**02**	**02**	**-**	**3**	**3**	**03**
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. *Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.* *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3* *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2* *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1* *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*										

COURSE CONTENT

Unit No	Unit Name	Hour
1	**FORGING PRACTICE**	**26**
2	**SHEET METAL PRACTICE**	**26**
3	**FOUNDRY SHOP**	**26**
	Total	**78**

UNITI: FORGING PRACTICE   26Hrs

Demonstration and detailed explanation of tools and equipment used-Description and specification of anvils, swage blocks, hammers, tongs, fullers, swages -Forging operations in smithy shop-Bending operation, upsetting operation,-Safety measures to be observed in the smithy shop

Hands on Experience
Job 1. To forge from Round to Square
Job 2. To forge from Round to Hexagon
Job 3: To forge a L-hook or L-nail.
Job 4: To prepare a job involving upsetting process
Job 5: To forge a chisel

UNTII: SHEET METAL PRACTICE   26Hrs
Introduction and demonstration of hand tools used in sheet metal shop.- different types of hammers, hard and soft mallet, sheet and wire gauge,- demonstration of various raw materials used in sheet metal shop e.g. M.S. sheet, galvanized-iron plain sheet, galvanized corrugated sheet, aluminum sheets etc.

Hands on Experience
Job I: Practice on making single riveted lap joint/double riveted lap Joint.
Job II: Practice on making single cover plate chain type, seam joint and Preparation of any one utility articles like Tray , Cylinder, container and Funnel.

UNITIII: FOUNDRY SHOP   26Hrs

Study of Foundry Tools and Equipment-Sand Mixing, Study of cope and drag-Practice in a single box-Cutting Practice by double box

Hands on Experience
Preparation of moulds-
Job I:Hexagon, Square and Circular Mould
Job II: Combination of Hexagon with Square or Circular Mould
Job III: Flange coupling – Pulley/ Gear pulley by using patterns

Elements of Workshop Technology (Vols. 1 and II) by Hajra Chaudhary

Note: the following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Instructor and Foreman with an intimation to HOD
2. Each student should conduct different activity and no repeation should occur

1	Take the students for local body building works observe the sheet metal practices followed in body building works .Submit hand written report of 500 words
2	Ask the students to observe the forging operations carried out in local vicinity and submit hand written report of 500 words
3	Take the students for industrial visit for a nearby foundry; observe the safety practices followed and foundry operational activities. Submit and written report of 500 words

Course Delivery:

The course will be delivered through Demonstration and Shop practices

Course Assessment and Evaluation Scheme:

	What		**To whom**	**When/Where (Frequency in the course)**	**Max Marks**	**Evidence collected**	**Course outcomes**
Direct Assessment meth	CIE	IA	Students	Activities	10	Report	1,2,3
				Record- Average marks of all graded exercises to be computed.	15	Graded exercises	1,2,3
	SEE	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, Effectiveness of Delivery of instructions & Assessment Methods

Note: 1. The activity related exercises shall be evaluated as per the Rubrics developed by the concerned department related to the course.

2. The course related graded exercises to be evaluated as per performance mentioned in SEE scheme of evaluation.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	**Bloom's Category**	**% Weightage**
1	**Understanding**	**40**
2	**Applying the knowledge acquired from**	**45**
3	**Analysis**	**10**
4	**Evaluation& Creating new knowledge**	**05**

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Student suggested activities report for 10 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Scheme of Valuation for End Examination

Note: Any one model from forging or sheet metal or foundry

Serial no	Description	Marks
1	Listing of tools & operations required for performing	05
2	Marking of job	05
3	Operation performed	10
4	Dimensional accuracy of job	10
5	Finishing of job	10
6	Viva	10
	TOTAL	50

EQUIPMENT LIST:

FOR FORGING PRACTICE

SL.NO	NAME OF THE EQUIPMENT	NO. OF STUDENTS/BATCH	NO.OF EQUIPMENT REQUIRED
01	Open hearth furnace	**20**	**04**
02	Flat tongs	20	20
03	Round tongs	20	20
04	Anvil	20	05
05	Sledge hammer	20	20
06	Flatener	20	20
07	Swage block	20	05

FOR SHEET METAL PRACTICE

SL.NO	NAME OF THE EQUIPMENT	NO. OF STUDENTS/BATCH	NO.OF EQUIPMENT REQUIRED
01	Steel Rule	20	20
02	Try square	20	20

03	Scriber	20	20
04	Shearing machine	20	04
05	Snip	20	20
06	Mallet	20	20
07	Bench vice	20	10
08	Stacks	20	04

FOR FOUNDRYPRACTICE

SL.NO	NAME OF THE EQUIPMENT	NO. OF STUDENTS/BATCH	NO.OF EQUIPMENT REQUIRED
01	Moulding boxes	20	20
02	Rammer	20	20
03	Flateners	20	20
04	Steel rule	20	20
05	Try square	20	20
06	Trowel	20	20
07	Strike off bar	20	20
08	Showel	20	05

MODEL QUESTIONS FOR FINAL EXAM

COURSE TITTLE: **BASIC WORK SHOP PRACTICE-II**

TIME: 3 HOURS   MARKS:50

FOR FORGING PRACTICE

1.Prepare the model as per the given sketch
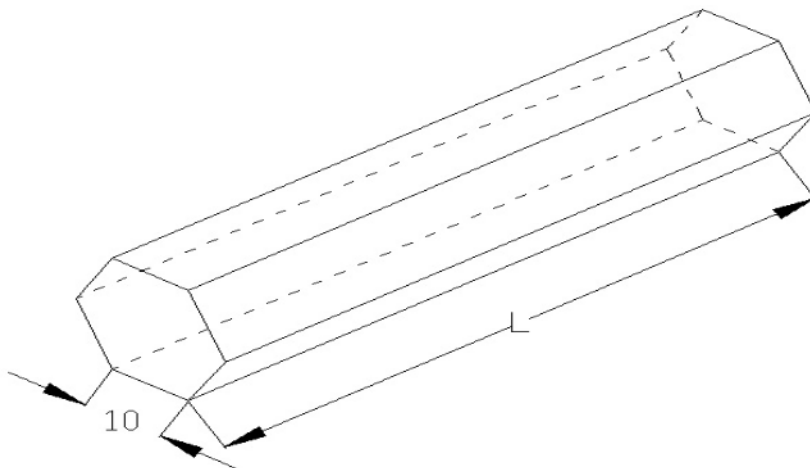
2.Prepare the model as per the given sketch

□10

1.Prepare the model as per the given sketch

□12
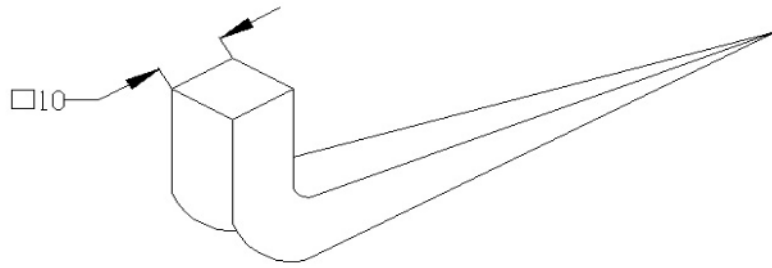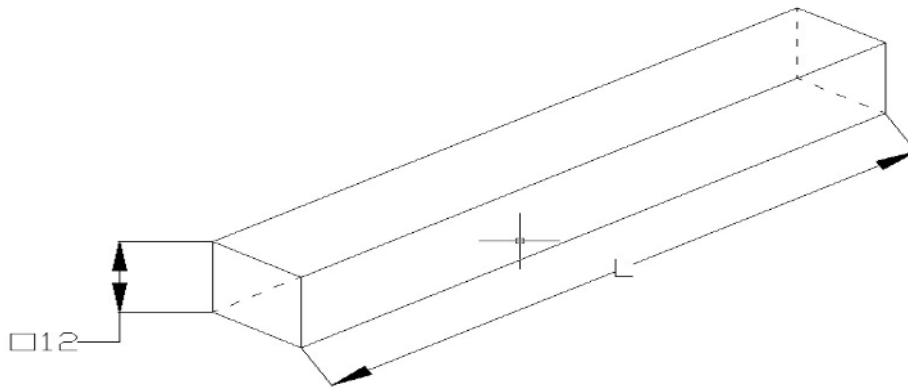
FOR SHEET METAL PRACTICE

1.Prepare the model as per the given sketch

Ø80

60

60

40

Ø20
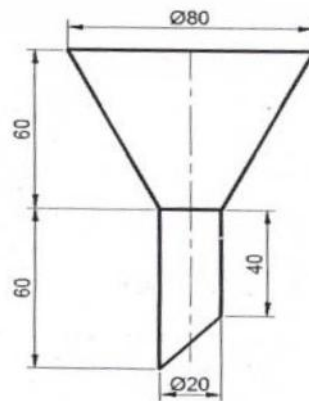
1.Prepare the model as per the given sketch
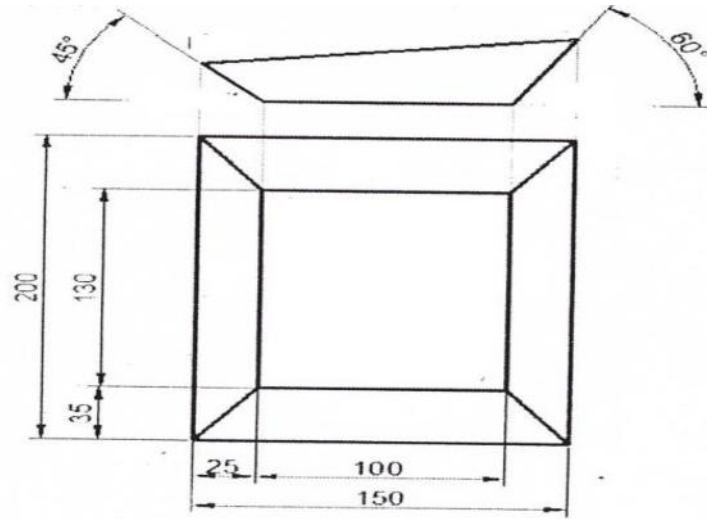
FOR FOUNDRYPRACTICE

1.Prepare the model as per the given sketch   2..Prepare the model as per the given sketch

3..Prepare the model as per the given sketch

	Course Title: **MECHANICAL TESTING AND QUALITY CONTROL LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME37P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Learning concepts of Strength of Materials and Mechanical Measurements

Course Objectives:

1. Evaluate the Mechanical Properties and quality of the materials used in engineering applications.

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Examine the Quality of lubricant by finding the properties of lubricants	*U/A*	1,2,3	1,2,3,6,8,10	**18**
CO2	Enumerate hardness and impact resistance of the materials before and after heat treatment	*U/A*	4,5	1,2,3,8,9,10	**15**
CO3	Evaluate the behavior of different materials experimentally subjected to tensile, compressive, shear and bending loads	*U/A*	6,7,8,9	1,2,3,8,9,10	**27**
CO4	Analyze the measuring dimension with specified dimensions on components	*U/A*	10,11,12,13	1,2,3,8,10	**15**
C05	Know about Weld defects/surface cracks	*U*	14	1,2,3,8,10	**03**
				Total sessions	**78**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL TESTING AND QUALITY CONTROL LAB	03	03	03	-	-	1	-	03	02	03

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
PART A. MECHANICAL TESTING		
1	Determine co efficient of friction of ant two oil by using Thurston oil tester and compare their results	06
2	Determine flash and fire point of any two lubricants of different grade and compare their results	06
3.	Determine viscosity of given oil by using Redwood viscometer/Saybolt viscometer.	06
4	Calculate Impact Value of Mild Steel, COPPER using CHARPY/ IZOD Impact Test & compare	06
5	Calculate hardness number by Brinell /Rockwell method Using hardness testing machine	09
6	Determination of yield stress, ultimate stress, breaking stress, percentage reduction in area, percentage elongation, Young's modulus by conducting tension test on Ductile Materials like Mild Steel, Aluminium in Universal testing machine. Draw Stress Strain Curve for both and compare	12
7	Find out Compressive Strength of C.I , M.S using Compression Testing Machine	06
8	Conducting bending test on wood specimen by UTM and evaluate the results	06
9	Conducting Shear test on mild steel specimen by UTM and evaluate the results	03
PART- B. QUALITY CONTROLL		
10	Standard use of basic measuring instruments: Surface plate, v-block, sprit level, combination set, filler gauge, plate gauge, wire gauge, screw pitch gauge, radius gauge, vernier caliper, micrometer and slip gauges, vernier height gauge, Vernier depth gaugeto measure dimension of given jobs.	06
11	Determine unknown angle of component using sine bar and slip gauges.	03
12	Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge.	03
13	Measurement of gear tooth elements by using gear tooth vernier caliper	03
14	Study on surface defects by Dye penetrant test/ ultrasonic portable equipment(Not for conduction)	03
	TOTAL	**78**

 Elements of Workshop Technology (Vols. 1 and II) by Hajra Chaudhary

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeation should occur*

1	Ask the students to bring two replaced Automobile/ Mechanical components, ask to select the instruments and measure the at least three dimensions. Record it in a sheet
2	Market Survey specific to properties of Various type of Materials used in Mechanical/Automobile industry or Any Engineering industries in local vicinity
3	Take the students for industrial visit for a nearby industry Select any two materials used for various mechanical engineering applications. Compare their mechanical properties

Course Delivery:

The course will be delivered through Demonstration and Shop practices

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3,4,5
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3,4,5
				Student Activity	05	Report	1,2,3,4,5
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4,5
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4,5 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Directorate Of Technical Education   Karnataka State   15ME37P MECH

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
1. Blue books (10 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

Serial no	Description	Marks
1	**Writing procedure** a) One experiment on (Mechanical testing) One experiment on (Quality control)	05+05=10
2	**Conducting of Experiment** a) One experiment on Mechanical testing(Group of five)+ One experiment on Quality control (Individual)	10+10=20
3	**Calculation and results,(Both experiments)**	15+5=20
	TOTAL	50

EQUIPMENT LIST: Quantity : 01 Each

1. Hardness Testing Machine
2. Impact Testing Machine
3. Thurston Oil Tester
4. Pensky Martin Flash & Fire point Equipment
5. Redwood and Saybolt viscometer.
6. Universal Testing Machine – (20 ton – 40 ton range)
7. Surface plate, v-block, sprit level, combination set, filler gauge, screw pitch gauge, radius gauge, verniercaliper, micrometer and slip gauges,vernier height gauge, Vernier depth gauge
8. Gear Tooth Vernier
9. Universal Bevel Protractor
10. Digital Micrometer
11. Digital Screwgauge
12. Sine Bar & Slip Gauges
13. Spirit Level
14. Surface Plate (Granite)
15. Wire and plate gauge.

	KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.												
	TEACHING AND EXAMINATION SCHEME FOR KANNADA COURSE IN DIPLOMA PROGRAME												
SEMESTER: III				COMMON TO ALL DIPLOMA PROGRAMMES								C-15 Curriculum	
SL.N0	COURSE NAME	Teaching Department	COURSE /QP CODE	Teaching scheme					Examination scheme					
				Contact hours									
				TH	TU	PR	TOTAL	Credit	Exam paper duration in Hrs	End exam		Maximum CIE Marks (IA+SA)	Minimum Marks for passing. (IA + SA)
										Max marks	Min marks		
	THEORY												
1	KANNADA KALI-1	KA	15KA3NT	2	-	-	2	2	-	-	-	-	50	20
2	TANTRIKA KANNADA -1	KA	15KA3KT	2	-	-	2	2	-	-	-	-	50	20

CIE- Continuous Internal Examination: SEE-Semester End Examination: IA-Internal Assessment Tests: SA- Student Activity.

Note: 1. Candidates studied Kannada as one subject in 10th standard shall take Tantrika Kannada 1 &2. Others may take "Kannada Kali-1&2".

2. In 3rd Semester- Assessment is only by CIE and no SEE. Average marks of three I A tests shall be rounded off to the next higher digit. Rubrics to be devised appropriately to assess student activity.

	KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.												
	TEACHING AND EXAMINATION SCHEME FOR KANNADA COURSE IN DIPLOMA PROGRAME												
SEMESTER: IV				COMMON TO ALL DIPLOMA PROGRAMMES								C-15 Curriculum	
SL.N0	COURSE NAME	Teaching Department	COURSE /QP CODE	Teaching scheme					Examination scheme					
				Contact hours									
				TH	TU	PR	TOTAL	Credit	Exam paper duration in Hrs	Sem End Exam		Maximum CIE Marks (IA+SA)	Minimum Marks for passing. (IA + SA)
										Max Exam Marks	Min Passing Marks		
	THEORY												
1	KANNADA KALI-2	KA	15KA4NT	2	-	-	2	2	2	50	20	-	-
2	TANTRIKA KANNADA -2	KA	15KA4KT	2	-	-	2	2	2	50	20	-	-

CIE- Continuous Internal Examination: SEE-Semester End Examination: IA-Internal Assessment Tests: SA- Student Activity.

Note: In 4th Semester- Assessment is only by SEE and no CIE. To award diploma certificate, passing in Kannada course is mandatory. However Kannada course is not included in the eligibility criteria for promotion to the higher semester.

3ನೇ ಸೆಮಿಸ್ಟರ್ ಕನ್ನಡ–1 (ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಪರಿಚಯ)

3rd Semester	Course: Kannada Kali-1	Course Code:15KA3NT (2016-17)
	No. of Credits:02	No. of teaching hours/week:02 No. of teaching hours/Semester:26
	Mode of Assessment and Evaluation: Continuous Internal Evaluation (CIE)only. I.A Tests:30 Marks (3 Tests) Student activities: 20 Marks	Maximum Marks: 50 (CIE only) Minimum Passing marks:20 (IA Tests + Student activities)

ಉದ್ದೇಶ:

1. ಕೇಳುವುದು, ಗ್ರಹಿಸುವುದು, ನಿರರ್ಗಳವಾಗಿ ಮತ್ತು ಸ್ಪಷ್ಟವಾಗಿ ಓದುವ ಮತ್ತು ಮಾತನಾಡುವ (ಅಭಿವ್ಯಕ್ತಿಸುವ) ಸಾಮರ್ಥ್ಯವನ್ನು ಬೆಳೆಸುವುದು.
2. ಜ್ಞಾನಾರ್ಜನೆ, ಸಾಹಿತ್ಯಾಭಿರುಚಿ, ಚಿಂತನೆ ಮತ್ತು ಆನಂದಕ್ಕಾಗಿ ಸ್ವತಂತ್ರವಾಗಿ ಓದಲು, ಬರೆಯಲು ಮತ್ತು ಮಾತನಾಡಲು ಸಮರ್ಥರಾಗುವಂತೆ ಮಾಡುವುದು.
3. ಪದ ಸಂಪತ್ತನ್ನು ಹೆಚ್ಚಿಸಿಕೊಂಡು ಸ್ಪಷ್ಟ ಉಚ್ಚಾರಣೆಯೊಡನೆ ಲಿಖಿತ ಮತ್ತು ಮೌಖಿಕ ಚಟುವಟಿಕೆಗಳನ್ನು ಮಾಡಿಸಿ, ಸ್ವತಂತ್ರವಾಗಿ ಭಾಷೆಯ ಬಳಕೆ ಮಾಡುವುದು.
4. ನಾಡು–ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಾಹಿತ್ಯಗಳ ಪರಿಚಯ ಮತ್ತು ಆತ್ಮಿಯ ಭಾವಾಭಿಮಾನವನ್ನು ಬೆಳೆಸುವುದು.
5. ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆಗಳಿಂದ ಭಾಷಾ ಕೌಶಲ್ಯದ ಸರಳ ಪ್ರಯೋಗ ಮಾಡಿಸುವುದು./ಕಲಿಸುವುದು.
(ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆ ಎಂದರೆ, ವರ್ಣಮಾಲೆ ಪರಿಚಯ, ವ್ಯಾಕರಣದ ಸರಳ ಪರಿಚಯ, ಗುಣಿತಾಕ್ಷರ, ಸಂಯುಕ್ತಾಕ್ಷರಗಳು, ನಾಮಪದ, ಲಿಂಗ, ವಚನ, ಪ್ರತ್ಯಯಗಳು, ವಾಕ್ಯರಚನೆ (ಕರ್ತೃ, ಕರ್ಮ, ಕ್ರಿಯಾಪದ) ಇತ್ಯಾದಿ)

ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಸರಳ ಭಾಷಾ ಕೌಶಲ್ಯ
(ಕನ್ನಡ ಕಲಿ–ಪಠ್ಯಪುಸ್ತಕ –ಶ್ರೀ ಲಿಂಗದೇವರು ಹಳೇಮನೆ – ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ ಪ್ರಕಾಶನ)
ಭಾಗ–1

ಪಾಠಗಳ ಕ್ರಮಾಂಕ Lesson No	ಪಠ್ಯವಸ್ತುವಿನ ವಿವರ – Curriculum Content	ಸೆಮೆಸ್ಟರ್ ಬೋಧನ ಆವಧಿ Total no.of Classes /Sem
	ಕನ್ನಡ ಭಾಷೆಯ ಪರಿಚಯ/ವರ್ಣಮಾಲೆ/'ಕನ್ನಡ ಕಲಿ'ಯುವ ವಿಧಾನ ಕುರಿತ ಮಾಹಿತಿ	02
1	Introducing each other Personal Pronouns, Possessive forms and Interrogative words 1. ನಾವು ಮತ್ತು ಭಾಷೆ 2. ಅಕ್ಷರಗಳಿಂದ ಪದಗಳು	03
2	Introducing each other Personal Pronouns, Possessive forms – Yes/No Type Interrogative	02
3	About Ramayana. Possessive forms of nouns, dubitive question, Relative nouns. ಪದಗಳಿಂದ ವಾಕ್ಯಗಳು	02
4	Enquiring about college. Qualitative and quantitative adjectives.	02
5	Enquiring about room. Predicative forms,	02

	locative case.		
6	Vegetable Market. Dative case, basic numerals.		02
7	About Medical college. Ordinal numerals, plural markers.		02
8	In a cloth shop. Color adjectives, defective verbs		02
9	Plan to go for picnic - imperative, permissive and hortative		02
10	Enquiring about one's family, Verb iru, and corresponding negation ಕನ್ನಡ ಚಿತ್ರಪಟಗಳಲ್ಲಿನ ಅಕ್ಷರಗಳನ್ನು ಗುರುತಿಸಿ ಓದಿ ದಿನಪತ್ರಿಕೆ ಓದುವ ಹವ್ಯಾಸ––ಸಂವಹನ ಮಾಧ್ಯಮದ ಬಗ್ಗೆ ಪರಿಚಯ		02
	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳು		03
		ಒಟ್ಟು ಗಂಟೆಗಳು	26

ಸೂಚನೆಗಳು:

• ಈ ಪತ್ರದ ಮೂಲ ಉದ್ದೇಶ ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳು ಸರಳ ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿ ವ್ಯವಹರಿಸುವಂತೆ ಮಾಡುವುದಾಗಿದೆ. "ಕನ್ನಡ ಕಲಿ" ಪುಸ್ತಕದ ಮೇಲಿನ ಪಾಠಗಳ ಜೊತೆಗೆ "ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆ"ಯಿಂದ ಗಳಿಸುವ ಅಕ್ಷರ ಜ್ಞಾನದಿಂದ ಪದ ಸಂಪತ್ತು ಹೆಚ್ಚಿಸಿ, ಪದಗಳಿಂದ ಸ್ವಂತ ವಾಕ್ಯಗಳ ರಚನೆ ಮಾಡಿಸುವುದು. (ಅಮ್ಮ, ಮೊಬೈಲ್, ಕನ್ನಡ ಭಾಷೆ, ಕವಿಗಳು, ನಾಟಕ, ಜನಪದ ಕಲೆ, ನಾಡಿನ ಪ್ರಸಿದ್ಧ ವ್ಯಕ್ತಿಗಳು, ಸಹೋದರ, ಸ್ನೇಹಿತ, ತರಕಾರಿ, ದೋಸೆ, ತಿಂಡಿ, ನಿದ್ದೆ, ಬಿಸಿ, ಚಳಿ, ಆಕಾಶ, ಓದು, ಇತ್ಯಾದಿ ನಿತ್ಯ ಬಳಕೆಯ ಸರಳ ಪದಗಳಿಂದ ವಾಕ್ಯರಚನೆ ಮತ್ತು 25–50 ಪದಗಳ ಕಿರು ಲೇಖನ ರಚನೆ).

• ತರಗತಿ ಚಟುವಟಿಕೆಗಳ ಪುಸ್ತಕದಲ್ಲಿ (ಕ್ಲಾಸ್ ಅಸೈನ್‌ಮೆಂಟ್) ಕನ್ನಡ ವರ್ಣಮಾಲೆಯ ಸ್ವರ, ವ್ಯಂಜನಗಳ ಅಕ್ಷರಗಳ ಬರವಣಿಗೆ ಅಭ್ಯಾಸ, ವ್ಯಂಜನಗಳಿಗೆ ಸ್ವರಗಳನ್ನು ಸೇರಿಸುವಿಕೆ, ಅಕ್ಷರಗಳಿಂದ ಪದರಚನೆ, ಪದಗಳಿಗೆ ಪ್ರತ್ಯಯಗಳನ್ನು ಸೇರಿಸುವುದು(ಗೆ, ಯಿಂದ, ಅನ್ನು, ಅಲ್ಲಿ, ಗಳು, ಎಂದು.....ಇತ್ಯಾದಿ ಪತ್ರದಲ್ಲಿ ಬರುವ ಪದಗಳಿಗೆ ನಿತ್ಯ ಬಳಕೆಯ ಪ್ರತ್ಯಯಗಳನ್ನು ಸೇರಿಸುವುದು) ಪದಗಳಿಂದ ವಾಕ್ಯ ರಚನೆ. ಮಾಡುವುದು. ಮತ್ತು ಪಾಠ 1–10ರ ಪಠ್ಯಾಂತ್ಯದಲ್ಲಿ ಬರುವ ಅಭ್ಯಾಸಗಳಲ್ಲಿ ಆರಿಸಿದ ಅಭ್ಯಾಸ ಭಾಗಗಳನ್ನು ಬರೆಸುವುದು. ಮತ್ತು ಪಾಠ–20 ರ ಸ್ಕ್ರಿಪ್ಟ್ ಅನ್ನು ಆಧಾರವಾಗಿಟ್ಟುಕೊಂಡು ಅಭ್ಯಾಸ ಮಾಡಿಸುವುದು.

ಆಕರ ಗ್ರಂಥಗಳು:

1. ಕನ್ನಡ ಕಲಿ–ಶ್ರೀ ಲಿಂಗದೇವರು ಹಳೇಮನೆ – ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರಾಥಮಿಕ ಶಾಲೆಯ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕಗಳು
3. ಸರಳ ಕನ್ನಡ ವ್ಯಾಕರಣ ಪುಸ್ತಕಗಳು– ಎಂ.ವಿ ನಾಗರಾಜರಾವ್/ಇತರೆ ಲೇಖಕರು.
4. ಪ್ರಯೋಗ ಪ್ರಣತಿ–ಪ್ರಥಮ ಪಿಯುಸಿ ಪೂರಕ ಪಠ್ಯ.
5. ಸರಳ ಪತ್ರವ್ಯವಹಾರದ ಪುಸ್ತಕಗಳು

ಪರೀಕ್ಷೆ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ವಿಧಾನ (3ನೇ ಸೆಮಿಸ್ಟರ್)

ನಿರಂತರ ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ– Continuous Internal Evaluation (CIE) only.

ಕ್ರ.ಸಂ.	ಚಟುವಟಿಕೆಗಳು	ವಿವರ	ಗರಿಷ್ಠಾಂಕ	ಉತ್ತೀರ್ಣತೆಗೆ ಕನಿಷ್ಠಾಂಕ
01	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ (I A Tests)	ಮೂರು ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳು (ಸರಾಸರಿ ಅಂಕಗಳನ್ನು ಪರಿಗಣಿಸುವುದು)	30	
02	ಕನ್ನಡ ಭಾಷಾ ಕೌಶಲ್ಯಾಭಿವೃದ್ಧಿ ಚಟುವಟಿಕೆಗಳು (Student Activities)	ಮೂರು ಚಟುವಟಿಕೆಗಳು (ಸರಾಸರಿ ಅಂಕಗಳನ್ನು ಪರಿಗಣಿಸುವುದು)	20	
		ಒಟ್ಟು ಅಂಕಗಳು	50	20

Course outcome:
1. Developing listening and speaking skills.
2. Easy Interaction with peers.
3. Students can use the language at ease in daily life situations

ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳ ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆಗಳು:

ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳಿಗೆ ಈ ಕೆಳಗಿನ ಮಾದರಿಯಲ್ಲಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆಯನ್ನು ಸಿದ್ಧಪಡಿಸಿ ನಡೆಸುವುದು ಮತ್ತು "ಕನ್ನಡ ಕಲಿ" ಪಠ್ಯದ ಕಲಿಕೆ ವಿವರಣೆ (ಭಾಷಾಭ್ಯಾಸ) ಸಂಭಾಷಣಾ ಭಾಗಗಳು ಮತ್ತು ಅಂತ್ಯದಲ್ಲಿ ಅಭ್ಯಾಸ ಪುಸ್ತಕದಲ್ಲಿ ಬರುವ ಪ್ರಶ್ನೆಗಳ ವಿಧಾನವನ್ನು ಪರ್ಯಾಯವಾಗಿ ಬಳಸಿಕೊಂಡು ಪ್ರಶ್ನೆಪತ್ರಿಕೆಗಳನ್ನು ತಯಾರಿಸಿಕೊಳ್ಳಬಹುದು.

ಡಿಪ್ಲೋಮಾ 3ನೇ ಸೆಮಿಸ್ಟರ್–ಕನ್ನಡ ಕಲಿ–1 (ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಪರಿಚಯ)

ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆ

ಸಮಯ: 60 ನಿಮಿಷಗಳು   ಅಂಕ: 30
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I.   Fill in the blanks using the appropriate words.(Any FOUR)   1X4=04
      i)   nimma raajya........................?
      ii)   adu..............pustaka?
      iii)   avana .... hesaru suratkal injiniyaring kaaleju.
      iv)   ondu ruupaayige..............paise.
      v)   aval.ige hindustaani sanita tumba..................
      vi)   nanage ninna sahavaasa khanDitaa.................
      vii)   avanu nimma ....?

II.   Use the following words (any FOUR) in your own sentences.   1X4=04
      1.adhyaapaki 2.snehita 3. Vyaapaara 4.keTTa 5. Hasiru 6.angadi 7.taaja

III. Answer the following questions (any FOUR)   1X4=04
      (a) nimma uuru yaavudu?
      (b) nivu diploma vidyaarthinaa?
      (c) nimma pennige estu ruupaaye?
      (d) nimma maatrubhaashe yaavudu?
      (e) nimage tingalige eshtu ruupaayi beeku?
      (f) nimma mane/ruumu elli ide?

IV.   Translate the following sentence in Kannada.   (any FOUR)   4X2=08
      1. Kannada is the language of Karnataka.
      2. My book is in my house.
      3. We have two houses in Bangalore.
      4. How much is this Pumpkin weighs?
      5. I want two packets of biscuits.
      6. How much do you pay rent for your room?
      7. What else do you want?

V. ಕೆಳಗಿನವುಗಳನ್ನು ಹೊಂದಿಸಿ ಬರೆಯಿರಿ. (Match the following)   1X4=04

1. ನೀವು ಯಾವಾಗ ಮನೆಯಲ್ಲಿ	1.ಇದೆ
2. ಪುಸ್ತಕ ಮೇಜಿನ ಮೇಲೆ	2.eldest son
3. Jaaga-ಜಾಗ	3.ಇತೀರಿ
4. Hiri maga	4.space

VI.   (1) Change into interragative using the underlined word. (Any Three)   1X3=03

1. Ivattu guruvaara.
2. evattu hattanee taariku
3. Aval hesaru liila.
4. Avara maatrabhaashe telagu alla.
5. Vavige ippttaydu ruupaayei beeku.
6. Adu maalatiya mane.

     (2) change into Interrogate.   (Any THREE)   1X3=03

1.ಹೌದು, ಇದು ಪುಸ್ತಕ.
2. ಆಗಲಿ, ಹೋಗೋಣ.
3. ಈಗ ಒಂದೂವರೆ ಗಂಟೆ.
4. ಅವರು ಮನೆಗೆ ಬರುತ್ತಾರೆ.
5.ನಾವಿ ಮನೆಗೆ ಹೋಗೋಣ.
6. ಅವರು ಮನೆಗೆ ಹೋಗಲಿ.

ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ ರಚನಾ ಸಮಿತಿ

- **ಸಂಪಾದಕೀಯ ಸಮಿತಿ:**

1. ಶ್ರೀ ಟಿ ಎಲ್ ರವೀಂದ್ರ, ಉಪನ್ಯಾಸಕರು, ಸರ್ಕಾರಿ ಜಿ.ಆರ್.ಐ.ಸಿ.ಪಿ ಬೆಂಗಳೂರು.
2. ಶ್ರೀ ಟಿ. ತಿಮ್ಮಪ್ಪ, ಉಪನ್ಯಾಸಕರು(ಆಯ್ಕೆ ಶ್ರೇಣಿ), ಯಾಂತ್ರಿಕ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಪಾಲಿಟೆಕ್ನಿಕ್, ತುಮಕೂರು.

- **ಸಲಹಾ ಸಮಿತಿಯ ಬಾಹ್ಯ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಗಳು.**

1. ಪ್ರೊ. (ಡಾ.) ಡಿ. ಪಾಂಡುರಂಗ ಬಾಬು, ಕುಲಸಚಿವರು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರೊ. (ಡಾ.) ಅಶೋಕ್ ಕುಮಾರ್ ರಂಜರೆ, ಪ್ರಾಧ್ಯಾಪಕರು, ಪ್ರಸಾರಾಂಗ ವಿಭಾಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
3. ಪ್ರೊ. (ಡಾ.) ಕೆ ವೈ ನಾರಾಯಣ ಸ್ವಾಮಿ, ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು, ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಕಲಾ ಕಾಲೇಜು, ಬೆಂಗಳೂರು.
4. ಪ್ರೊ. (ಡಾ.) ಜೆ ಬಾಲಕೃಷ್ಣ, ಪ್ರಾಧ್ಯಾಪಕರು ಹಾಗು ಮುಖ್ಯಸ್ಥರು, ಕನ್ನಡ ಭಾಷಾ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ, (ಜಿಕೆವಿಕೆ) ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು.

3ನೇ ಸೆಮಿಸ್ಟರ್ – ತಾಂತ್ರಿಕ ಕನ್ನಡ –1 (ಸಾಹಿತ್ಯ ಮತ್ತು ಭಾಷಾ ಕೌಶಲ್ಯ ಪ್ರಯೋಗ)
ಪಠ್ಯಕ್ರಮ

<table>
<tr>
<td rowspan="3">3rd Semester</td>
<td>Course:
ತಾಂತ್ರಿಕ ಕನ್ನಡ –1</td>
<td>Course Code:15KA3KT
(2016-17)</td>
</tr>
<tr>
<td>No. of Credits:02</td>
<td>No. of teaching hours/week:02
No. of teaching hours/Semester:26</td>
</tr>
<tr>
<td>Mode of Assessment and Evaluation:
Continuous Internal Evaluation (CIE)only.
I.A Tests:30 Marks
(3 Tests)
Student activities:
20 Marks</td>
<td>Maximum Marks: 50 (CIE only)
Minimum Passing marks:20
(IA Tests + Student activities)</td>
</tr>
</table>

ಪಠ್ಯ ಪ್ರಕಾರ	ಪಾಠ	ಪಠ್ಯದ ಹೆಸರು/ಲೇಖಕರು/ಪ್ರಕಟಣೆ	ಸೆಮಿಸ್ಟರ್ ಬೋಧನಾವಧಿ ಗಂಟೆಗಳು
ಇತಿಹಾಸ	1	'ಸಂಸ್ಕೃತಿ'- ದೇ.ಜೆ.ಗೌ (ನಾಟ್ಯ ಸಂಸ್ಕೃತಿ–ದೇ.ಜೆ.ಗೌ)	02
ಸಂಸ್ಕೃತಿ	2	ನಮಗೆ ಬೇಕಾಗಿರುವ ಇಂಗ್ಲಿಷ್– ಕುವೆಂಪು	02
ಪರಿಸರ	3	ಆನೆ ಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ	02
ಕ್ರೀಡೆ/ಜೀವನಕಲೆ	4	ಸೋಲೆಂಬುದು ಅಲ್ಪವಿರಾಮ – ನೇಮಿಚಂದ್ರ	02
ಯಶೋಗಾಥೆ/ವ್ಯಕ್ತಿಚಿತ್ರಣ	5	ಬದುಕನ್ನು ಪ್ರೀತಿಸಿದೆ ಸಂತ – ಎಚ್.ಆರ್.ರಾಮಕೃಷ್ಣ (ಕಲಾರಂಗ ವ್ಯಕ್ತಿ ಚಿತ್ರ)	02
ತಂತ್ರಜ್ಞಾನ	6	ಮಂಗಳನ ಅಂಗಳದಲ್ಲಿ – ಜೆ.ಬಾಲಕೃಷ್ಣ	02
ಭಾಷಾ ಕೌಶಲ್ಯ ಚಟುವಟಿಕೆಗಳು	7	*ಮೌಖಿಕ ಅಭಿವ್ಯಕ್ತಿ: ಸಹಜ ಭಾಷಾ ಬಳಕೆ: .ಆಶು ಭಾಷಣ> ವಿವಿಧ ರಚನಾತ್ಮಕ/ದೈನಂದಿನ ಬಳಕೆ ವಸ್ತು, ವ್ಯಕ್ತಿ, ಭಾವನೆಗಳ ಮೇಲೆ. ಒಂದು ಸಣ್ಣ ಏಕಾಂಕ (5–10 ನಿಮಿಷ) ನಾಟಕ. ಮಾದರಿ ಸಂದರ್ಶನ (ನೇಮಕಾತಿಗಾಗಿ ಸಂದರ್ಶನ)	06
ಲಿಖಿತ ಚಟುವಟಿಕೆಗಳು	8	ವಿಸ್ತರಣೆ: ನುಡಿಗಟ್ಟುಗಳು–ಪದಗಳನ್ನು ಬಳಸಿಕೊಂಡು ಸಣ್ಣ ವಾಕ್ಯಗಳ ರಚನೆ ಪರ್ಯಾಯ ಪದಗಳನ್ನು ಬರೆಯುವುದು(ಉದಾ: ಬಳಸು=ಉಪಯೋಗಿಸು, ಕಾಯು= ನಿರೀಕ್ಷಿಸು, ಚಿಂತಿಸು=ಯೋಚಿಸು, ಕೂಡಿಸುವಿಕೆ=ಸೇರಿಸುವಿಕೆ.......ಇತ್ಯಾದಿ)	06
		ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳು	02
		ಒಟ್ಟು ಗಂಟೆಗಳು	26

ತಾಂತ್ರಿಕ ಕನ್ನಡ–1

3ನೇ ಸೆಮಿಸ್ಟರ್ ಡಿಪ್ಲೋಮಾದ ಕನ್ನಡ ಪಠ್ಯ (ಕನ್ನಡ ಬಲ್ಲವರಿಗಾಗಿ)

1. ಪಠ್ಯರಚನಾ ಸಮಿತಿ
2. ನಿರ್ದೇಶಕರ ಮುನ್ನುಡಿ
3. ಪಠ್ಯ ರಚನಾ ಸಮಿತಿ ಮಾತುಗಳು
4. ಪಠ್ಯಕ್ರಮ

ಪರಿವಿಡಿ

<u>ಗದ್ಯ ವಿಹಾರ</u>

1. ನಾಟ್ಯ ಸಂಸ್ಕೃತಿ   (ಇತಿಹಾಸ)   – ದೆ.ಜೆ.ಗೌ
2. ನಮಗೆ ಬೇಕಾಗಿರುವ ಇಂಗ್ಲಿಷ್ (ಸಂಸ್ಕೃತಿ)   _ ಕುವೆಂಪು
3. ಸೋಲೆಂಬುದು ಅಲ್ಪವಿರಾಮ (ಕ್ರೀಡೆ/ಜೀವನಕಲೆ)   – ನೇಮಿಚಂದ್ರ
4. ಆನೆ ಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು (ಪರಿಸರ)   _ ಬಿ.ಜಿ.ಎಲ್.ಸ್ವಾಮಿ
5. ಬದುಕನ್ನು ಪ್ರೀತಿಸಿದ ಸಂತ (ಯಶೋಗಾಥೆ/ವ್ಯಕ್ತಿಚಿತ್ರಣ) – ಎಚ್.ಆರ್.ರಾಮಕೃಷ್ಣ
6. ಮಂಗಳನ ಅಂಗಳದಲ್ಲಿ.....   – ಡಾ:ಜೆ.ಬಾಲಕೃಷ್ಣ

<u>ಭಾಷಾ ಕೌಶಲ್ಯ–ಚಟುವಟಿಕೆಗಳು</u>

7. ಮೌಖಿಕ ಅಭಿವ್ಯಕ್ತಿ ಚಟುವಟಿಕೆಗಳು
8. ಲಿಖಿತ ಅಭಿವ್ಯಕ್ತಿ ಚಟುವಟಿಕೆಗಳು

Course outcome:
1. Developing listening and speaking skills.
2. Easy Interaction with peers.
3. Students can use the language at ease in daily life situations

ಪರೀಕ್ಷೆ ಮತ್ತು ಮೌಲ್ಯಮಾಪನ ವಿಧಾನ (3ನೇ ಸೆಮಿಸ್ಟರ್)

ನಿರಂತರ ಅಂತರಿಕ ಮೌಲ್ಯಮಾಪನ– Continuous Internal Evaluation (CIE) only.

ಕ್ರ.ಸಂ.	ಚಟುವಟಿಕೆಗಳು	ವಿವರ	ಗರಿಷ್ಠಾಂಕ	ಉತ್ತೀರ್ಣತೆಗೆ ಕನಿಷ್ಠಾಂಕ
01	ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ (I A Tests)	ಮೂರು ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಪರೀಕ್ಷೆಗಳು (ಸರಾಸರಿ ಅಂಕಗಳನ್ನು ಪರಿಗಣಿಸುವುದು)	30	
02	ಕನ್ನಡ ಭಾಷಾ ಕೌಶಲ್ಯಾಭಿವೃದ್ಧಿ ಚಟುವಟಿಕೆಗಳು (Student Activities)	ಮೂರು ಚಟುವಟಿಕೆಗಳು (ತಾಂತ್ರಿಕ ಪ್ರಬಂಧ/ಅತುಭಾಷಣ/ಚರ್ಚೆ/ತಾಂತ್ರಿಕ ಕ್ಷೇತ್ರಗಳಲ್ಲಿನ ಅವಿಷ್ಕಾರಗಳ ಬಗ್ಗೆ ವಿಶ್ಲೇಷಣೆ ಇತ್ಯಾದಿ.) (ಸರಾಸರಿ ಅಂಕಗಳನ್ನು ಪರಿಗಣಿಸುವುದು)	20	
		ಒಟ್ಟು ಅಂಕಗಳು	50	20

ಸೂಚನೆ:

ಭಾಷಾ ಚಟುವಟಿಕೆಗಳಿಗಾಗಿ   ತರಗತಿ ಚಟುವಟಿಕೆಗಳ ಪುಸ್ತಕದಲ್ಲಿ (ತರಗತಿಯ ಪ್ರಗತಿಪರ ಮೌಲ್ಯಮಾಪನ). ಗಾದೆಗಳ ವಿಸ್ತರಣೆ, ನುಡಿಗಟ್ಟುಗಳು, ಸಂಭಾಷಣೆ ಮಾದರಿಗಳು ಮತ್ತು ಪಠ್ಯದ ಸಾಹಿತ್ಯ ಭಾಗದ ಪಾಠಗಳ ಮೇಲೆ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರ– ಟಿಪ್ಪಣಿ ಮತ್ತು ಶಬ್ದಾರ್ಥದಲ್ಲಿ ಬರುವ ಪದಗಳಿಂದ ವಾಕ್ಯ ರಚನೆ ಮಾಡಿಸುವುದು.

- **ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ**

3ನೇ ಸೆಮಿಸ್ಟರ್– ತಾಂತ್ರಿಕ ಕನ್ನಡ–1 (ಕನ್ನಡಬಲ್ಲ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ)

ಸಮಯ: 1.00 ಗಂಟೆ   ಅಂಕಗಳು:30

ಸೂಚನೆ: ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳಿಗೆ ಸೂಚನೆಗಳ ಪ್ರಕಾರ ವ್ಯಾಕರಣದೋಷವಿಲ್ಲದಂತೆ ಉತ್ತರಿಸಿ.
*****

1. ಈ ಕೆಳಗಿನ 04 ಪ್ರಶ್ನೆಗಳಿಗೆ ಒಂದು ಪೂರ್ಣ ವಾಕ್ಯದಲ್ಲಿ ಉತ್ತರಿಸಿ.   1*4=04
   (ಅ) ನಾಟ್ಯ ಯಾವಾಗ ಹುಟ್ಟಿಕೊಂಡಿತು?
   (ಆ) ಆನೆ ಹಳ್ಳದ ಕಾಡಿನಲ್ಲಿ ನಾಪತ್ತೆಯಾದ ಹುಡುಗಿಯರ ಹೆಸರುಗಳನ್ನು ತಿಳಿಸಿ.
   (ಇ) ರಾಷ್ಟ್ರಪತಿಯಾಗಿ ಆಯ್ಕೆಯಾದಾಗ ಕಲಾಂ ಅವರು ಮೊದಲು ಹೇಳಿದ ಮಾತುಗಳೇನು?
   (ಈ) ಮಂಗಳನ ಅಂಗಳ ತಲುಪಿದ ಮೊದಲ ಅಂತರಿಕ್ಷ ನೌಕೆ ಯಾವುದು?
   (ಉ) 'ಹಗಲುಗನಸು' ನುಡಿಗಟ್ಟನ್ನು ಬಳಸಿ ಸ್ವಂತ ವಾಕ್ಯವನ್ನು ರಚಿಸಿ.
   (ಊ) 'ಸಿಹಿಕಹಿ' ಜೋಡುಪದವನ್ನು ಒಂದು ವಾಕ್ಯದಲ್ಲಿ ಬಳಸಿ.

2. ಕೆಳಗಿನ ಯಾವುದೇ ನಾಲು ಪ್ರಶ್ನೆಗಳಿಗೆ ಕನಿಷ್ಠ ಐದಾರು ವಾಕ್ಯಗಳಲ್ಲಿ ಉತ್ತರಿಸಿ.   4*4=16
   (1) ಕುವೆಂಪು ಅವರು ಇಂಗ್ಲಿಷ್ ಕಲಿಯುವವರನ್ನು ಎಷ್ಟು ವಿಭಾಗವಾಗಿ ಹೇಗೆ ವಿಂಗಡಿಸಿದ್ದಾರೆ?
   (2) ಕಲಾಂ ಅವರ ಯಶಸ್ಸಿನ ಮಂತ್ರಗಳೇನು?
   (3) ಗಾದೆಗಳ ಮಹತ್ವವೇನು? ನಿಮಗೆ ಗೊತ್ತಿರುವ ಯಾವುದೇ ಎರಡು ಗಾದೆಗಳನ್ನು ಹೆಸರಿಸಿ.
   (4) ಸಂವಹನ ಸಂದರ್ಭದಲ್ಲಿ ಬಳಸುವ ಭಾಷೆ ಹೇಗಿರಬೇಕು?
   (5) ನೇಮಿಚಂದ್ರರ 'ಸಾವಿನತ್ತ ಒಂದು ಹೆಜ್ಜೆ ' ಕತೆ ಓದಿದ ಹುಡುಗಿ ತನ್ನ ಸೋಲಿನಿಂದ ಹೊರಗೆ ಬಂದದ್ದು ಹೇಗೆ?
   (6) ಸಂದರ್ಶನ ಎಂದರೇನು? ವಿವರಿಸಿ.

3. ಯಾವುದೆ ಎರಡು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ.   2*5=10
   (1) ನಾಟ್ಯಕಲೆಯಲ್ಲಿ ಯಕ್ಷಗಾನ ಕಲೆ ಪ್ರಮುಖವಾದುದು. ಇದರ ಹುಟ್ಟು ಮತ್ತು ವ್ಯಾಪ್ತಿ ಬಗ್ಗೆ ತಿಳಿಸಿ.
   (2) ಮಂಗಳಯಾನದ ಮುಖ್ಯ ಉದ್ದೇಶಗಳೇನು?
   (3) 'ಮಾನವೀಯ ಮೌಲ್ಯಗಳು', ಅಂತರಜಾಲ – ಎರಡರಲ್ಲಿ ಒಂದಕ್ಕೆ ಸುಮಾರು ಒಂದು ಪುಟದಷ್ಟು ಪ್ರಬಂಧ   ಬರೆಯಿರಿ.
   (4) ಉದ್ಯೋಗದ ಸಂದರ್ಶನಕ್ಕೆ ಹೋಗುವಾಗ ಮಾಡಿಕೊಳ್ಳಬೇಕಾದ ಪೂರ್ವಸಿದ್ಧತೆಗಳೇನು?.

ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ ರಚನಾ ಹಾಗು ಪಠ್ಯಪುಸ್ತಕ ಸಮಿತಿ

- **ಸಂಪಾದಕೀಯ ಸಮಿತಿ:**

1. ಶ್ರೀ ಟಿ ಎಲ್ ರವೀಂದ್ರ, ಉಪನ್ಯಾಸಕರು, ಸರ್ಕಾರಿ ಜಿ.ಆರ್.ಐ.ಸಿ.ಪಿ ಬೆಂಗಳೂರು.
2. ಶ್ರೀ ಟಿ. ತಿಮ್ಮಪ್ಪ, ಉಪನ್ಯಾಸಕರು(ಆಯ್ಕೆ ಶ್ರೇಣಿ), ಯಾಂತ್ರಿಕ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಪಾಲಿಟೆಕ್ನಿಕ್, ತುಮಕೂರು.

- **ಸಲಹಾ ಸಮಿತಿಯ ಬಾಹ್ಯ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಗಳು.**

1. ಪ್ರೊ. (ಡಾ.) ಡಿ. ಪಾಂಡುರಂಗ ಬಾಬು, ಕುಲಸಚಿವರು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರೊ. (ಡಾ.) ಅಶೋಕ್ ಕುಮಾರ್ ರಂಜರೆ, ಪ್ರಾಧ್ಯಾಪಕರು, ಪ್ರಸಾರಾಂಗ ವಿಭಾಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
3. ಪ್ರೊ. (ಡಾ.) ಕೆ ವೈ ನಾರಾಯಣ ಸ್ವಾಮಿ, ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು, ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಕಲಾ ಕಾಲೇಜು, ಬೆಂಗಳೂರು.
4. ಪ್ರೊ. (ಡಾ.) ಜೆ ಬಾಲಕೃಷ್ಣ, ಪ್ರಾಧ್ಯಾಪಕರು ಹಾಗು ಮುಖ್ಯಸ್ಥರು, ಕನ್ನಡ ಭಾಷಾ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ, (ಜಿಕೆವಿಕೆ) ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು.

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **HYDRAULICS & PNEUMATICS**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME41T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit **:04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Science.

Course Objectives:

1. To gain knowledge on the fundamental aspects of fluid flow physics and properties of fluid flow and selection of hydraulic machinery for relevant applications.
2. To learn various flow measurement techniques.

Course Outcomes:

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand fluid dynamics	*R/U/A*	1,2,3,10	**07**
CO2	Analyze the application of mass, momentum and energy equation in fluid flow.	*R/U/A*	1,2,3,10	**09**
CO3	Calculate and compare flow rates, pressure changes, minor and major head losses for viscous flows through pipes	*R/U/A*	1,2,3,6, 10	**06**
CO4	Evaluate the performance of Hydraulic turbines and operation and performance of centrifugal and reciprocating pumps	*U/A*	1,2,3,4,6, 10	**10**
CO5	Apply knowledge and Select, operate and maintain various hydraulic elements for a particular low cost automation application in sustainable manufacturing system and its impact on society	*R/U/A*	1,2,3,4,6, 10	**10**
CO6	Apply knowledge and Select, operate and maintain various pneumatic elements for a particular low cost automation application in sustainable manufacturing system and its impact on society.	*R/U/A*	1,2,3,4,10	**10**
		Total sessions		**52**

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks weightage	weightage (%)
			R	U	A		
1	INTRODUCTION TO HYDRAULICS	07	5	10	5	20	14
2	DYNAMICS OF FLUIDS	09	5	5	15	25	17
3	FLOW THROUGH PIPES	06	5	5	5	15	12
4	HYDRAULIC MACHINES	10	--	10	20	30	19
5	HYDRAULIC SYSTEMS	10	5	10	15	30	19
6	PNEUMATIC SYSTEMS	10	5	10	10	25	19
	Total	52	25	50	70	145	100

R-Remember; U-Understanding; A-Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL MEASUREMENTS	3	3	3	2	-	2	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENTS

UNITI: INTRODUCTION TO HYDRAULICS   07Hrs

Fluid- Concept and classification of fluid-Newton's law viscosity-Properties of fluid-Density, Specific gravity, Specific Weight, Specific Volume- Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility-Fluid pressure, Pressure head, Pressure intensity-Concept of absolute vacuum, gauge pressure, atmospheric Pressure-pressure,- Simple and differential manometers, Bourdon pressure gauge.

UNTII: DYNAMICS OF FLUIDS   09Hrs

Fluid flow-Types of fluid flows-Continuity equation-Bernoulli's theorem-Venturi meter– Construction, principle of working, Coefficient of discharge, Discharge through venture meter.- Orifice meter-Pitot tube – Construction, Principle of working,- hydraulic coefficients -Numerical on Bernoulli's theorem, venturi meter, orifice meter.

UNITIII: FLOW THROUGH PIPES   06Hrs

Concepts of fluid friction- Loss of head due to friction- Minor losses in pipes -Darcy's equation and Chezy's equation for frictional losses.- -Hydraulic gradient and total gradient line.- Hydraulic power transmission through pipe- Numerical to estimate Loss of head due to friction and major and minor losses- Power transmission. Concept of water hammer in pipes.

UNIT IV: HYDRAULIC MACHINES   10Hrs

Hydraulic turbines- Classification of turbine -Construction and working principle of Pelton wheel, Francis and Kaplan turbine.-Use of Penstock, Anchor Block, Surge tank and Draft tube. Concept of cavitations in turbines- Simple Numerical on Calculation of Discharge, Work done, Power, efficiency of turbine(Exclude Francis turbine)
Pumps- classification of pumps – construction and working of Centrifugal pump- Need for priming of centrifugal pump–multistage centrifugal pump. Reciprocating pump-types-construction and working- Air Vessel-Slip-Simple Numerical on Calculation of discharge, Work done, Power, efficiency of pumps-construction and working Submersible pump

UNIT V: HYDRAULIC SYSTEM   10Hrs

Hydraulic systems- layout of oil hydraulic systems-. Advantages of hydraulic systems-Components of Hydraulic systems- Pumps– Vane pump, gear pump, screw pump,-Valves – working and symbols of Pressure control valves – pressure relief valve, Direction control valves - 3/2, 5/2 valves,-Sequence valves.-Flow control valves–Actuators- Linear Actuators – Cylinders - single acting, double acting - Hydraulic motors-Accumulators-Types.

UNIT VI: PNEUMATICSYSTEM   10Hrs

Pneumatic system- General layout of pneumatic system-Advantages of pneumatic systems-Components of pneumatic system- Compressor – Reciprocating.-construction and working of FRL unit- working and symbols of-Control Valves – Pressure regulating valves, Flow Control valves, Direction Control Valves.-Actuators - Cylinders- single acting and double acting - Air motors,- piston motor-unit- - Pneumatic Symbols- ports and positions

 TEXT BOOKS

1. Bansal. R.K.,*"Fluid Mechanics and Hydraulics Machines"*, 9th Edition, LaxmiPublicationsPrivate Limited, New Delhi. 2011.
2. R.S.Khurmi, *"Fluid Mechanics and Machinery",*S.Chand and Company, 2nd Edition, 2007.
3. *Hydraulics & Pneumatics* – Andrew Parr, Jaico Publishing House New Delhi.
4. *Hydraulic and Pneumatic Controls Understanding Made Easy*- K.S.Sundaram,-S.chand Company Delhi

REFERENCES
1. Ramamritham. S, *"Fluid Mechanics, Hydraulics and Fluid Machines"*, DhanpatRai&Sons,Delhi, 2004.
2. Kumar. K.L., *"Engineering Fluid Mechanics",* 7th Edition, Eurasia Publishing House PrivateLimited, New Delhi, 1995.
3. P. N Modi and S. M. Seth*, "Hydraulics and Fluid Mechanics Including Hydraulics Machines"*, 19th Edition, Standard Book House, 2013
4 Bansal R. K, *"Strength of Materials",*Laxmi Publications, New Delhi, 2012.
5. *Oil Hydraulic Systems*- Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013
6. *Hydraulic and Pneumatic Controls*- Srinivasan, R.- Vijay Nicole Imprints Private Limited, 2/e, 2008
7. *Pneumatic And Pneumatics Controls* -Understanding Made Easy - K.S.Sundaram,-S.chand Company Delhi
8. *Pneumatic Systems* - Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. www.youtube.com/watch?v=VyR8aeioQrU
2. http://www.youtube.com/watch?v=R6_q5gxf4vs
3. www.howstuffworks.com
4. . http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT- KANPUR/machine/ui/TOC.htm
5. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
6. https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5
7. http://www.youtube.com/watch?v=0p03UTgpnDU
8. http://www.youtube.com/watch?v=A3ormYVZMXE
9. http://www.youtube.com/watch?v=TjzKpke0nSU
10. http://www.youtube.com/watch?v=vl7GteLxgdQ
11. http://www.youtube.com/watch?v=cIdMNOysMGI
12. www.boschrexroth.co.in
13. http://www.automationstudio.com/
14. http://www.howstuffworks.com/search.php?terms=hydraulics
15. http://hyperphysics.phy-astr.gsu.edu/hbase/fluid.html#flucon
16. http://www.youtube.com/watch?v=FVR7AC8ExIM
17. http://www.youtube.com/watch?v=iOXRoYHdCV0
18. http://www.youtube.com/watch?v=qDinpuq4T0U
19. http://www.youtube.com/watch?v=xxoAm3X4iw0
20. www.festo.com
21. www.boschrexroth.co.in
22. www.nptel.iitm.ac.in
23. http://www.howstuffworks.com/search.php?terms=pneumatics

24. http://www.youtube.com/watch?v=MbKrIieogNc
25. http://www.youtube.com/watch?v=7JuNbHb5NrQ
26. http://www.youtube.com/watch?v=NakOoD-G0IY
27. http://www.youtube.com/watch?v=bG2mCiQgbwE
28. http://www.youtube.com/watch?v=cB3OCPqmUDQ
29. http://www.youtube.com/watch?v=5q7YasmwXCs
30. http://www.youtube.com/watch?v=a5Ebx__l5-g

Course Delivery:
- The course will be delivered through lectures and Power point presentations/ Video
- Teachers can prepare or download ppt of different topic's Hydraulic power engineering application, can prepare alternative slides.

- Prepare/Download a dynamic animation to illustrate the following:
  • Working principle of hydraulic pumps/Hydraulic devices
  • Working principle of hydraulic valves and actuators/ Pneumatic valves and actuators

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Each student will give an activity to prepare a tabulated summary for types of fluid which is available around city (Summary includes properties of fluid indicated in chapter-1)
2	List out any five pressure measuring devices available in market with its specifications and current market price.
3	Each student will give an activity to prepare a tabulated summary for types of pipes available in market. (Summary includes type, specification, size range, material, rate and applications).
4	Identify any one hydraulic pump and one prime mover available in market in a group of five students with detail specifications and current price.
5	Visit a nearby related Earth moving equipments service centre and prepare a summary of hydro-pneumatic devices used along with their specifications
6	Motivate student to take case study on Low Cost Automation to inculcate self and continuous learning

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4

5

Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
			Average / Total marks=(4+5+3+2)/4=14/4=3.5=4			

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student Activities	05	Activity sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	% Weightage
1	Understanding	45
2	Applying the knowledge acquired from	25
3	Analysis	20
4	Evaluation& Creating new knowledge	10

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Note to IA verifier: **The following documents to be verified by CIE verifier at the end of semester**
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**HYDRAULICS & PNEUMATICS**	20
	Year:		

Name of Course coordinator :				Units:__			
CO's:____							

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER
4- Semester Diploma Examination
HYDRAULICS AND PNEUMATICS

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>SIX</u> from Part A and any <u>SEVEN</u> from Part B

Part A   6x5=30 marks

1. List the different properties of the fluid.
2. Define the following
   i) Laminar flow   ii) Turbulent flow,
   iii)Steady flow   iv) Uniform flow
   3.Identify major energy losses and minor energy losses.
   4.State the applications of Hydraulics system.
5.Explain manometer and classify.
6.Classify of control valves.

   7.Explain the general layout of pneumatic system.
   8.The water is flowing through a pipe having diameters 200 mm and 100 mm at sections
   1 and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m

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above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 X 10^4 N/m^2 ,find the intensity of pressure at section 2.

9.APelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.

Part-B

10. a)Explain with neat sketch the pitot tube. 04

   b)An oil of specific gravity 0.8 is flowing through a venturi meter having inlet 06diameter 200mm and throat diameter 100mm .The oil-mercury differential manometer shows a reading of 250 mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

11.a)Indicate the factors for selection of Hydraulic turbine.   04

   b)A Pelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.

12. a)Write short on air motors.

b)Explain with neat sketch, the double-acting cylinder.

13.a)Sketch and explain the gear pump.

b)Sketch and explain the Spring loaded Accumulator.

14.a)Explain hydraulic gradient and total energy lines.

b)Find the loss of head, due to friction, in a pipe of 500 mm diameter and 1.5 kilometres long. The velocity of water in the pipe is 1m/s. Take co-efficient of friction as 0.005.

   15.a)Classify of control valves.   4

      b)Sketch and explain the 5/2 DC valve.   6

16.a) Explain the terms with units.   4

            i) Dynamic viscosity   ii)kinematic viscosity.

   b)Illustrate the relationship between different pressure with diagram.   6

17.a)Explain the continuity equation and Bernoulli's equation.   5

      b)Explain with neat sketch the working of multistage pump for high head.   5

18.a)Explain slip, negative slip and Percentage Slip of Reciprocating pump.   5

   b)Explain briefly FRL unit.

19.Distinguish between :   10.

 i) Steady flow and unsteady flow   ii) Uniform and non uniform flow

 iii) Compressible and incompressible flow   iv) Rotational and irrotational flow

MODEL QUESTION BANK

4- Semester Diploma Examination

HYDRAULICS AND PNEUMATICS

CO-1:UNDERSTAND FLUID DYNAMICS

Remembrance

1. Define the following properties:

a)Density   b) Weight density   c) Specific volume

d)Specific gravity   e) Viscosity

2. Define the following properties

a) Dynamic viscosity   b)kinematic viscosity.

c)Surface tension.

3.Define Newtonian and non Newtonian fluids

4.Defineand explain Newton's law of viscosity.

5.Describe manometer. How are they classified.

6.List the different properties of the fluid.

7.Define a)Atmospheric pressure, b)Gauge pressure   c)Absolute pressure.

Understanding

1. Explain the terms with units.

     a) Dynamic viscosity   b)kinematic viscosity.

2. Explain surface tension.

3. Explain the phenomenon of capillary tube.

4. Distinguish between ideal fluids and real fluid.

5. Distinguish between manometers and mechanical gauges and list different types

Of mechanical pressure gauges.

6.Explain manometer and classify.

Application

1 .Explain with a neat sketch explain Bourdon's tube pressure gauge.

2. Explain with a neat sketch Simple monometer.

3. Explain with a neat sketch Differential manometer.

4. Illustrate the relationship between different pressure with diagram.

5. Write different advantages and disadvantages of manometer.

CO-2:ANALYZE THE APPLICATION OF MASS, MOMENTUM AND ENERGY EQUATION IN FLUID FLOW.

Remembrance

1. Define equation of continuity.

2. Define the following
   i) Laminar flow   ii) Turbulent flow,
   iii)Steady flow   iv) Uniform flow
3. Define the following
   i) Compressible fluid   ii) Incompressible flow
4. State Bernoulli's theorem for steady flow of an incompressible fluid.
5. State the Bernoulli's theorem. Mention the assumptions made.
6. Define continuity equation and Bernoulli's equation.
7. List the different applications of Bernoulli's theorem .
8. Define hydraulics co-efficient.

   Understanding
   9. Explain equation of continuity.
10. Distinguish between :
    i) Steady flow and unsteady flow   ii) Uniform and nonuniform flow
    iii) Compressible and incompressible flow   iv) Rotational and irrotational flow
    v) Laminar and Turbulent flow
11. Explain pitot tube.
12. Explain the continuity equation and Bernoulli's equation.
    Application
13. Explain with neat sketch the pitot tube.
14. Explain the working orifice meter with neat sketch.
15. Explain the principal of venturi meter with a neat sketch.
    16. Water is flowing through a pipe of 50 mm diameter under a pressure of
        $29.43 \times 10^4 N/m^2$ and with mean velocity of 2.0m/s. Find the total head or total energy
        per unit weight of the water at a cross-section, which is 5m above the datum line.
17. A pipe through which water is flowing, is having diameters 200mm and 100mm at the
    cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 4.0m/s.
    Find the velocity head at sections 1 and 2 and also rate of discharge.
18. The water is flowing through a pipe having diameters 200 mm and 100 mm at sections 1
    and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m
    above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24×10^4
    N/m^2 ,find the intensity of pressure at section 2.
19. Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and
    upper end respectively. The intensity of pressure at the bottom end is $24.525 \times 10^4 N/m^2$
    and the pressure at the upper end is $9.81 \times 10^4 N/m^2$.Determine the difference in datum
    head if the rate of flow through pipe is 40 lit/sec.
20. The water is flowing through a taper pipe of length 100 m having diameters 600 mm at
    the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a
    slope of   1 in 30. Find the pressure at the lower end if the pressure at the higher level is
    $19.62 \times 10^4 N/m^2$

21. A horizontal venture meter with inlet and throat diameters 300mm and 150mm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and throat is 200mm mercury. Determine the rate of flow. Take C_d = 0.98.

22. An oil of specific gravity 0.8 is flowing through a venturi meter having inlet diameter 200mm and throat diameter 100mm .The oil-mercury differential manometer shows a reading of 250 mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

23. A horizontal venturi meter with inlet diameter 200mm and throat diameter 100mm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturi meter is 60 litres/sec. Find the reading of the oil-mercury differential manometer. Take C_d = 0.98.

24. A pipe through which water is flowing is having diameters 400mm and 200mm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 5.0 m/s. Find the velocity head at section 1 and 2 and also rate of discharge.

25. An oil of specific gravity 0.9 is flowing through a venturi meter having inlet diameter 200mm and throat diameter 100mm. The oil-mercury differential manometer shows a reading of 200mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

26. The water is flowing through a pipe having diameters 200 mm and 150mm at section 1 and section 2 respectively. The rate of flow through pipe is 40 liters/sec. The section 1 is 6m above the datum line and section 2 is 3m above the datum. If the pressure at section 1 is $29.43 \times 10^4 N/m^2$, find the intensity of pressure at section 2.

27. A horizontal venturi meter with inlet and throat diameters 300mm and 150mm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet throat is 100mm of mercury. Determine the rate of flow. Take C_d = 0.98 .

28. The water is flowing through a taper pipe of length 50m having diameters 400mm at the upper end and 200mm at the lower end, at the rate of 60 liters/sec. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the higher level is $24.525 \times 10^4 N/m^2$.

29. An orifice meter with orifice diameter 100mm is inserted in a pipe of 200mm diameter. The pressure gauges fitted upstream and downstream of orifice meter given readings of $19.62 \times 10^4 N/m^2$ and $9.81 \times 10^4 N/m^2$ respectively. Co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe.

30. An orifice meter with orifice diameter 150mm is inserted in a pipe of 300mm diameter. The pressure difference measured by mercury oil differential manometer on the two sides of the orifice meter gives a reading of 500mm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the co-efficient of discharge of meter = 0.64.

CO-3: CALCULATE AND COMPARE FLOW RATES, PRESSURE CHANGES, MINOR AND MAJOR HEAD LOSSES FOR VISCOUS FLOWS THROUGH PIPES

Remembrance

1. Define loss of head in pipes due to friction.
2. Identify major energy losses and minor energy losses.
3. Describe hydraulic gradient and total energy lines.
4. State Darcy's and Chezy's formula for fluid flow through pipes.
5. Describe different types of losses in fluid flow through pipes.
6. State the condition for maximum transmission of power.
7. Describe water hammer in pipes.

Understanding

8. Explain major energy losses and minor energy losses.
9. Explain hydraulic gradient and total energy lines.
10. Explain Darcy's and Chezy's formula for fluid flow through pipes.
11. Explain different types of losses in fluid flow through pipes.
12. Explain with the help of a line diagram
    a) Hydraulic gradient line
    b) Total energy line.
13. Explain the maximum efficiency of transmission of power.
14. Explain water hammer in pipes.

Applications

1. Write short notes water hammer.
2. Write short notes on power transmission through pipes.
3. Write short notes on losses of head due to friction through pipes.
4. Find the loss of head, due to friction, in a pipe of 500 mm diameter and 1.5 kilometres long. The velocity of water in the pipe is 1m/s. Take co-efficient of friction as 0.005.
5. Water is flowing through a pipe of 1500 m long with a velocity of 0.8 m/sec. What should be the diameter of the pipe, if the loss of head due to friction is 8.7m. Take f for the pipe as 0.01.
6. It was observed that the difference of heads between the two ends of a pipe 250 metres long and 300 mm diameter is 1.5 metres. Taking Darcy's coefficient as 0.01 and neglecting minor losses, calculate the discharge through the pipe.
7. A pipe of 60 metres long and 150 mm in diameter is connected to a water tank at one end and flows freely into the atmosphere at the other end. The height of water level in the tank is 2.6 metres above the centre of the pipe. The pipe is horizontal and f = 0.01. Determine the discharge through the pipe in litres/sec., if all the minor losses are to be considered.
8. A reservoir has been built 4 km away from a college campus having 5000 inhabitants. Water is to be supplied from the reservoir to the campus. It is estimated that each inhabitant will consume 200 litres of water per day, and that half of the daily supply is pumped within 10 hours. Calculate the size of the supply main, if the loss of head due to friction in pipeline is 20 m. Assume f = 0.008.
9. Find the head lost due to friction in a pipe 1 m in diameter and 1.5 km long when the water is flowing with a velocity of 1 m/sec., by using Darcy's equation with f = 0.020.
10. Water is supplied to a town of 4,00,000 inhabitants. The reservoir is 6.4 kilometres away from the town and loss of head due to friction in pipeline is measured as 1.5 m. Calculate the size of the supply main, if each inhabitant consumes 180 litres of water per day and half of the daily supply is pumped in 8 hours. Take the frictional factor for pipeline is 0.030.

11. Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4 m of water. Take the value of f = 0.009.

12. Determine the rate of flow of water through a pipe of diameter 200mm and length 50 m. When one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of the water in the tank is 4 m above the centre of the pipe. Consider all minor losses and take f = 0.009.

13. Water is flowing through a pipe of diameter 200mm with a velocity of 3 m/sec. Find the head lost due to friction for a length of 5 m if the coefficient of friction f = 0.021.

14. Find the head lost due to friction in a pipe of diameter 300mm and length 50 m, through which water is flowing at a velocity of 3 m/sec. Using i) Darcy formula for which f = 0.0026, ii) Chezy's formula for which C = 60.

15. Find the diameter of a pipe of length 2000 m when the rate of flow of water through the pipe is 200 litres/sec. and the head lost due to friction is 4 m. Take the value of C = 50 in Chezy's formulae.

16. A pipe of 300 m long with a diameter of 0.3 m is supplying water. Calculate the discharge of water through the pipe, the loss of head due to friction is 1.5 m. Take Darcy's coefficient as 0.01.

17. Calculate the discharge through a pipe of diameter 200mm when the difference of pressure head between the two ends of pipe 500 m apart is 4 m of water. Take the value of 'f' = 0.009.

18. Water flows through a pipe of 200 mm in diameter 60 m long with a velocity of 2.5 m/sec. Find the head loss due to friction by using Darcy's formula, assuming f = 0.005and by using Chezy's formula, assuming C = 55.

19. Find the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400 m. The rate of flow of water through the pipe is 300 litres/sec. Consider all losses and take the value of f = 0.008.

20. In a power station, water is available from a reservoir at a head of 75 m. If the efficiency of transmission is 60%, find the power available when 1.25 m^3 of water flows to the station in one section.

21. Find the maximum power that can be transmitted by a power station through a hydraulic pipe of 3 kilometres long and 200 mm diameter. The pressure of water at the power station is 1500 kPa. Take f = 0.01.

22. The pressure at the inlet of a pipeline is 400 kPa and the pressure drop is 200 kPa. The pipeline is 1.5 kilometre long. If 100 KW is to be transmitted over this pipeline, find the diameter of the pipe and efficiency of transmission. Take f = 0.006.

23. A town having a population of 1,20,000 is to be supplied with water from a reservoir at 5 km distance. It is stipulated that one half of the daily supply of 150 litres per head should be delivered within 8 hours. What must be the size of the pipe to furnish the supply, if the head available is 12 metres. Take C = 45 in Chezy's formula.

24. A pipe 3.2 kilometres long and of 0.9 m diameter is fitted with a nozzle of 200 mm diameter at its discharge end. Find the velocity of water through the nozzle, if the head of water is 50 m. Take f = 0.006 for the pipe.

25. A hydro-electric plant is supplied water at the rate of 500 litres/sec., under a head of 250 m through a pipeline 3.2 kilometres long and 500 mm diameter. The pipeline terminates in a nozzle, which has a diameter of 200 mm. find the power that can be transmitted, if the Darcy's coefficient for the pipe is 0.01.

26. A pipe of 75 mm diameter and 250 m long has a nozzle of 25 mm fitted at the discharge end. If the total head of the water is 48 m, find the maximum power transmitted. Take f as 0.01 for the pipe.

27. A pipe having a diameter 300 mm and length 3500 m is used for transmission of power by water. The total head available at pipe inlet is 500 m. Find the maximum power available at the outlet of the pipe, if f = 0.006.

CO-4: EVALUATE THE PERFORMANCE OF HYDRAULIC TURBINES AND OPERATION AND PERFORMANCE OF CENTRIFUGAL AND RECIPROCATING PUMPS

Understanding

1. Classify hydraulic turbine with examples.
2. Explain with the help of a line diagram the working principle of Impulse turbine.
3. Differentiate impulse with reaction turbines.
4. Explain the concept of cavitations in turbine.
5. Explain different Efficiency turbine.
6. Explain Draft tube. Mention its types.
7. Explain a)Penstock b)Anchor block
8. Explain Surge tank and mentions its function.
9. Indicate the factors for selection of Hydraulic turbine.
10. Indicate the functions of draft tube.
11. Classify the pumps.
12. Explain the priming in centrifugal pump.
13. Classify the various Reciprocating pumps.
14. Explain slip and negative slip of the pump.
15. Explain with a line diagram the working of Submersible pump.
16. Differentiate between the centrifugal pump and reciprocating pumps.
17. Explain slip, negative slip and Percentage Slip of Reciprocating pump.
18. Explain: (i) Slip (ii) Negative slip and (iii) Coefficient of discharge in reciprocating pump.

Applications

1. Explain with the help neat sketch, the working principle of Impulse turbine.
2. Show construction and the working principle of pelton wheel.
3. Explain the construction and the working of Francis turbine with a neat sketch.
4. Explain the construction and working of Kaplan turbine with a neat sketch.
5. Explain with neat sketch the following.
   a)Penstock b)Anchor Block.
6. Explain Surge tank with a neat sketch.
7. Explain surge tank with neat sketch.
8. Explain the multistage centrifugal pump with a neat sketch.

9. Explain with a neat sketch, constructional details and principle ofoperation of a centrifugal pump.
10. Explain with neat sketch the working of multistage pump for high head.
11. Explain with neat sketch the working of multistage pump for high discharge.
12. Explain with a neat sketch the construction and working of Single acting Reciprocating pump.
13. Explain with a neat sketch the construction and working of Double acting Reciprocating pump.
14. Explain with a neat sketch air vessel and its functions.
15. Write about Reciprocating pump and Mention its types.
16. Explain with a line diagram the working of Submersible pump.
17. A Pelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.
18. A Pelton wheel, having semicircular buckets and working under a head of 140meters, is running at 600rpm. The discharge through the nozzleis500 litres/sec and diameter of the wheel is 600mm. Find: a) Power available at the nozzle,   b) Hydraulic efficiency of the wheel, if coefficient of velocity is 0.98.
19. A Pelton wheel, working under a head of 500 metres, produces 13000 kW at 430 r.p.m. If the efficiency of the wheel is 85%, determine a) Discharge of the turbine. b)Diameter of the wheel. c) Diameter of the nozzle. Assume suitable data.
20. In Hydro electric scheme the distance between high level reservoir at the top of the mountains and the turbine is 1.6Km and difference of their levels is 500m. The water is brought in 4 penstocks each of diameters of 0.9 metres connected to a nozzle of 200mm at the end. Find a) Power of each jet, and b) Total power available at the reservoir, taking the value of Darcy's co-efficient of friction as 0.008.
21. The Pykara power house in south India is equipped with impulse turbines of pelton type. Each turbine delivers a maximum power of 14250KW, when working under a head of 900m, and running 600rpm. Find the diameter of the jet, and the mean diameter of the wheel. Take overall efficiency of turbine as 89.2%.
22. A Pelton wheel is required to generate 3750KW under an effective head of400m. Find the total flow in litres/sec and size of the jet. Assume Generator efficiency 95%, Overall efficacy 80%, co-efficient of velocity 0.97, Speed ratio 0.46. If the jet ratio is 10, find the mean diameter of the runner.
23. The overall efficiency of a pelton wheel is 86% when the power developed is 500KW under a head of 80m. If the coefficient of velocity for the nozzle is 0.97, find the diameter of the nozzle.
24. A pelton wheel of 1m diameter is working under a head of 150m. Find the speed of the runner, if the coefficient of velocity and velocity ratio is 0.98 and 0.47 respectively.
25. A pelton wheel producing 1350KW under a head of 80m at 300 rpm. Find the diameter of the wheel, if the speed ratio is 0.45.Take $C_V = 0.98$.

26. A Kaplan turbine, operating under a net head of 20m, develops 20,000KW with an overall efficiency of 86%. The speed ratio is 2.0 and flow ratio is 0.6. The hub diameter of the wheel is 0.35 times the outside diameter of the wheel. Find the diameter and speed of the turbine.

27. A propeller turbine runner has an outer diameter of 4.5m and an inner diameter of 2.5m and develops 21,000KW when running at 140rpm. under a head of 20m. The hydraulic efficiency is 94% and overall efficiency is 88%. Find discharge through the turbine, and guide blade angle at inlet.

28. A Kaplan turbine working under a head of 5.5m develops 7500 KW. The speed ratio and flow ratio are 2.1 and 0.71 respectively. If the boss diameter is 1/3 of that of the runner and overall efficiency is 85%. Find the diameter of the runner and speed of the turbine.

29. A centrifugal pump delivers water at 30ltrs/sec to a height of 18m through a pipe of 90m long and 100mm diameter. If the overall efficiency of the pump is 75%, find the power required to drive the pump. Take f = 0.012.

30. A centrifugal pump delivers 60ltrs of water per sec to a tank situated at a height 20m. If the overall efficiency of the pump is 70%. Find the power required for the pump.

31. A centrifugal pump having an overall efficiency of 75% is discharging 30ltrs of water per sec through a pipe of 150mm diameter and 125m long. Calculate the power required to drive the pump, if the water is lifted through a height of 25m. Take coefficient friction as 0.01.

32. A double acting reciprocating pump as a stroke of 300mm and a piston of diameter 150mm. The delivery and suction head of 26m and 4m respectively including friction heads. If the pump is working at 60rpm, find power required to drive the pump with 80% efficiency.

33. A single acting reciprocating pump having a bore of 150mm diameter and Stroke of 300mm length discharges 200ltrs of water per minute. Neglecting losses, find
 a) Theoretical discharge in litre/minute.   b)Coefficient of dischargec)Slip of the pump.

34. A single acting reciprocating pump having cylinder diameter of 150mm and stroke 300mm is used to raise water to a total height of 30m.Find the power required to drive the pump, if the crank rotates at 60rpm.

35. A double acting reciprocating pump of plunger diameter 100mm and stroke of 250mm length is discharging water into a tank fitted 20m higher than the axis of the pump. If the pump is rotating at 45rpm, find the power required to drive the pump.

CO-5: APPLY KNOWLEDGE AND SELECT, OPERATE AND MAINTAIN VARIOUS HYDRAULIC ELEMENTS FOR A PARTICULAR LOW COST AUTOMATION APPLICATION IN SUSTAINABLE MANUFACTURING SYSTEM AND ITS IMPACT ON SOCIETY

Remembrance

1. State the advantages of Hydraulics system.
2. State the applications of Hydraulics system.
3. List the hydraulics system components.
4. Name the different types of valves used in hydraulics system.

5. Describe a)Pressure relief valve   b)Direction control valve
6. Describe   a)Flow control valve   b)Actuators
7. State the classification of control valves.
8. Describe Accumulator.

Understand

1. Give the difference between external gear pump and lobe pump.
2. Differentiate between simple pressure relief valve and pilot operated pressure relief valve.
3. Explain is flow control valve.
4. Explain the   non-return valve.
5. Classify of control valves.

Applications

1. Explain the hydraulic system with neat sketch.
2. Sketch and explain the gear pump.
3. Explain the working principle of lobe pump with neat sketch.
4. Sketch and explain the vane pump.
5. Sketch and explain the 5/2 DC valve.
6. Sketch and explain simple relief pressure valve.
7. Explain with neat sketch the pilot operated pressure relief valve.
8. Sketch and explain the pressure reducing valve.
9. Sketch and explain the non-return valve.
10. Sketch and explain the pilot operated valve.
11. Sketch and explain the pilot operated sequence valve.
17. Sketch and explain the Spring loaded Accumulator.

18. Explain with a neat sketch single acting cylinder.

19. Explain with a neat sketch double acting cylinder.

CO-6: APPLY KNOWLEDGE AND SELECT, OPERATE AND MAINTAIN VARIOUS PNEUMATIC ELEMENTS FOR A PARTICULAR LOW COST AUTOMATION APPLICATION IN SUSTAINABLE MANUFACTURING SYSTEM AND ITS IMPACT ON SOCIETY

Remembrance

1. State the applications of pneumatics.
2. State and explain the Pascal's law.

3. List the components of pneumatic system.
4. State the advantages of pneumatic system.
5. Describe are the pneumatic actuators.
6. State the applications of single-acting cylinder and double-acting cylinder.

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7. List any five pneumatic symbols.

8. State the functions of FRL unit.

Understanding
        1. Explain the Pascal's law.

2. Explain the pneumatic DCV with its symbolic representation.

3. Explain the pneumatic actuators.

4. Explain the general layout of pneumatic system.

5. Explain air motor.

6. Explain briefly FRL unit.

      Applications

        1. Sketch and explain the arrangement of pneumatic components.

2. Sketch and explain the vane compressor.

3. Explain the application of 2/2 DCV with its neat sketch.

4. Sketch and explain the 3/2 DCV.

5. What is 5/2 DCV. Explain with its neat sketch.

6. Explain with neat sketch, the single-acting cylinder.

7. Explain with neat sketch, the double-acting cylinder.

8. Explain air motor with Sketch.

9. Explain the piston motor with sketch.

10. Sketch and explain the gear motor.

11. Explain the working principle of vane motor with its neat sketch.

12. Write short on air motors.

13. Sketch the following pneumatic symbols.

    a)FRL unit   b)Air motor   c)3/2 Pilot valve   d)Single acting actuator

    c)Flow control valve.

	Course Title: **BASIC THERMAL ENGINEERING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME42T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Applied Science

Course Objectives:

1. It is a science of energy transfer and its effect on physical properties of substances. It is based upon observations of common experiences of energy (mainly heat) transfer.
2. This course will provide an understanding of the basic principles of thermodynamics which is must for understanding of major fields of mechanical engineering system

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Apply basic concepts, laws and principles of thermodynamics to use and select equipments/devices/machines working on these basics	*R/U/A*	1,2,3,4,6,10	**10**
CO2	Outline various Thermodynamic process and analyze them with respect to various parameters	*R/U/A/An*	1,2,3,4,6,10	**10**
CO3	Understand the Limitations, applications and Comparison of Thermodynamic cycles based on different parameters.	*R/U/A*	1,2,3,4,10	**11**
CO4	Analyze performance of ICEs by operating them and observing changes in thermodynamic properties during each stroke of ICEs (and by using thermodynamic diagrams.)	*R/U/A/An*	1,2,3,4,6,10	**12**
CO5	Calculate heat transfer for given heat transfer system	*U/A*	1,2,3,4,10	**05**
CO6	Identify the elements of gas turbines and processes of Jet propulsion system	*R/U*	1,2,3,4,10	**04**
			Total sessions	**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
BASIC THERMAL ENGINEERING	3	3	3	3	-	3	-	-	-	3
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.										
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.										
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3										
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2										
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1										
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	BASIC CONCEPTS AND LAWS OF THERMODYNAMICS	10	5	5	15	25	17
2	THERMODYNAMIC PROCESSES	10	5	5	20	30	21
3	THERMODYNAMIC CYCLES	11	5	5	20	30	21
4	IC ENGINES-PERFORMANCE OF I.C ENGINES	12	5	10	20	35	24
5	HEAT TRANSFER	05	-	5	10	15	10
6	GAS TURBINE AND JET PROPULSION SYSTEMS	04	5	5	-	10	07
	Total	52	25	35	85	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: BASIC CONCEPTS AND LAWS OF THERMODYNAMICS   10 Hrs

Basic concepts-Definitions :system - boundary, surrounding, working fluid and state of a system.-thermodynamic systems – closed, open and isolated systems with examples-Properties of system- Intensive and Extensive properties with examples.-Definitions for properties like Enthalpy (H), Entropy(s) Internal energy (U)- Specific heat at constant pressure(C_p), specific heat at constant volume(C_v) for a gas-Relation between C_p &C_v , characteristic gas equation, Universal gas constant, Definitions for quasi-static work flow-Law of thermodynamics-Zeroth, first & second laws of thermodynamics- simple problems on conversion of Heat into Work and vice versa., Problems on gas equations-Steady flow energy equation (without proof)

UNTII: THERMODYNAMIC PROCESSES   10 Hrs

Thermodynamic processes,- Explain with P-V and T-S diagram the Constant pressure, Constant volume, Isothermal, Isentropic, Polytrophic, Free expansion and throttling processes & equations representing the processes- Derivation for work done for the above processes- Calculation of change in internal energy, heat supplied or rejected, change in Entropy for the above processes. Simple problems on the above processes .

UNITIII: THERMODYNAMIC CYCLES   11Hrs

Thermodynamic cycle – reversible and irreversible cycles conditions for reversibility of a cycle-Explanation of Carnot cycle with P.V. and T-S diagrams, Air standard Efficiency - Problems on Carnot cycle-Explanation of Otto cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Otto cycle-Explanation of Diesel cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Diesel cycle.-Explanation of Dual cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on dual cycle.

UNIT IV: IC ENGINES- PERFORMANCE OF I.C ENGINES   12Hrs

IC engine -definition-classification- Terminology of IC engine - Working principle of Two Stroke petrol & Diesel engine - Working principle of Four Stroke petrol & Diesel engine. Testing of IC engines-Rope brake Dynamometer-Formulae for Brake power, Indicated power Mechanical efficiency, Indicated thermal efficiency, Brake thermal efficiency, Air standard efficiency, Relative efficiency, Volumetric efficiency-Concept of Heat balance sheet for an engine-Simple problems on testing of I.C. engines and heat balance sheet

UNIT V:HEAT TRANSFER   05Hrs

Introduction -Methods of heat transfer-- Conduction, convection and radiation -Fourier's law of heat conduction-Newton law of cooling- Stefan-Boltzmann law -Heat transfer by conduction through slab and composite wall- Heat transfer by Radiation: -Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Radial heat transfer by conduction through thick cylinder-Simple problems on above (conduction only)

UNIT VI: GAS TURBINE AND JET PROPULSION SYSTEMS   04 Hrs

Gas turbines- classification of gas turbines-Closed cycle gas turbine-Schematic diagram-explanation-Open cycle gas turbine-schematic diagram-explanation-Comparison of open cycle and closed cycle gas turbines.-Jet propulsion-Ram–jet engine ,turbojet engines and Rocket engine- principle of working & application.

📕 TEXT BOOKS AND REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Heat Engines	Pandya and Shah	Charotar Publishing House
2.	Thermodynamics and Heat power Engg.	Mathur and Mehta	Tata Mcgraw- Hill
3	A Text book of Thermal Engineering	R S Khurmi& J K Gupta	S Chand
4.	Thermal Engineering	P.L.Ballaney	Khanna.Publishers
5	Thermal Engineering	A. S. Sarao	SatyaPrakashan
6	Thermal Engineering	R K Rajput	Laxmi.Publications
7	Practical Thermodynamics	G D Rai	Khanna Publisher

LIST OF SOFTWARES/ LEARNING WEBSITES:

a. http://www.nptel.iitm.ac.in/video.php?subjectId=112105123 (IIT-B Video lectures)
b. http://www.thermofluids.net/
c. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm
d. http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html
e. http://www.youtube.com/watch?v=Xb05CaG7TsQ
f. http://www.youtube.com/watch?v=aAfBSJObd6Y
g. http://www.youtube.com/watch?v=DHUwFuHuCdw
h. http://www.youtube.com/watch?v=kJlmRT4E6R0
i. http://www.youtube.com/watch?v=GKqG6n6nAmg

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Identify and list real situations which works on: a: Zeroth law. b: First law of thermodynamics. c: Second law of thermodynamics.
2	Identify different Thermodynamic process in real situations.
3	Prepare charts of diesel, duel and gasoline cycles. Tabulate main points of differences between them.
4	Write the specifications of I.C.Engine of any two wheelers. Also Construct & explain cycle on which that I.C.Engine works.
5	*Arrange visit to any gas turbine power plant/Diesel engine power plant, study the operational features of Gas turbines/Diesel engines*

Course Delivery:
- The course will be delivered through lectures and Power point presentations/ Video

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory** **1**	**Developing** **2**	**Satisfactory** **3**	**Good** **4**	**Exemplary** **5**	**Student Score**
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activities sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**BASIC THERMAL ENGG.**	20
	Year:	Course code:15ME42T	

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	IVSEM	**BASIC THERMAL ENGG.**	20
	Year: 2016-17	Course code:15ME42T	

Name of Course coordinator :	Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Differentiate between intensive and extensive properties of a system. Give three examples for each.	04	U	1	1,2, 3,6, 10
2	A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200ºC is expanded in a cylinder to 1.2 m^3 at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K. **OR** A closed system undergoes a change in process in which 5 kJ of heat energy is supplied to the system. Determine the change in internal energy under the following conditions. i) 1 kJ of work is done on the system. ii) 1.25 kJ of work is done by the system.	06	A	1	1,2, 3,4, 6,10
3	Derive an expression for work done during polytrophic process.	04	U	2	1,2, 3,4, 6,10
4	One kg of gas expands reversibly and adiabatically. Its temperature during the process falls from 515K to 390K, while the volume is doubled. The gas does 92 kJ of work in this process Calculate: The value C_p and C_v **OR** A gas has a molecular mass of 26.7. The gas is compressed through a ratio of 12 according to the law PV$^{1.25}$ = C, from initial conditions of 0.9 bar and 333 K. Assuming specific heat at constant volume C_v = 0.79 kJ/kg K. Calculate per kg of mass, work done and heat flow across the cylinder walls. Gas constant and ratio of specific heat.	06	A	2	1,2, 3,4, 6,10

IV- Semester Diploma Examination

Course Title: **BASIC THERMAL ENGINEERING**

Time: **3 Hours**]   [Max   Marks**: 100**

Note: Answer any **SIX from PartA** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1.   Define the terms: (i) system (ii) boundary and (iii) surroundings.

2.   A closed system received a heat transfer of 120 kJ and delivers a work transfer of 150 kJ. Determine the change of internal energy.

3.   Derive expression for work done in constant temperature process with PV diagram.

4.   A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200ºC is expanded in a cylinder to 1.2 m^3 at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K.

5.   List the assumptions made in thermodynamic air standard cycle.

6   Define IC engine and give the classification of IC engines.

7.   Explain following terms:

  a) Volumetric efficiency b) Mechanical efficiency

8.   State and derive Fourier's law of heat conduction.

9.   State the applications and limitations of gas turbine.

PART-B

1.   a. Differentiate between intensive and extensive properties of a system. Give three examples for each.   04
      b. A cold storage is to be maintained at -5º while surroundings are at 35ºC. The leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual C.O.P. of the refrigeration plant is one - third of an ideal plant working between the same temperatures. Determine the power required to drive the plant.   06

2.   a) Prove that C_p-C_v=R   04

      b) A piston - cylinder containing air expands at a constant pressure of 150 KPa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and change in internal energy during the process C_p = 1.01 kJ/kg K and C_v = 0.72 kJ/kg K.   06

3.   a) List the thermodynamic processes on gases.   04

      b)A piston cylinder containing air expands at a constant pressure of 150 kpa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and the change in internal energy during the process. Take C_p = 1 kJ/kg K, R = 0.287 kJ/kg K.   06

4. a. Derive an expression for work done during polytrophic process.　　　　04

    b. A gas of mass 0.56 kg is expanded adiabatically from a pressure at 8 bar to 1 bar adiabatically. Initial temperature of the gas is 200ºC. Determine the work done and change in internal energy. Take C_p = 1 kJ/kg K and C_v = 0.714 kJ/kg K.　　　06

5. Explain with the help of P-V and T-S diagrams working of Otto cycle and derive an expression for the air standard efficiency of it.　　　　10

6. A certain quantity of air at a pressure of 1 bar and temperature 70ºC is compressed reversibly and adiabatically until the pressure is 7 bar in an Otto cycle engine. 460 kJ of heat per kg of air is now added at constant volume.

    Determine:

    i)Compression ratio of the engine.　　ii)Temperature at the end of compression.

    iii)Temperature at the end of heat addition.Take for air, C_P = 1 kJ/kg K and

    C_V = 0.707 kJ/kg .　　　　10

7. a) Compare petrol and diesel engines.　　　　04

    b) A heat engine has a piston diameter of 150 mm, length of stroke 400 mm and mean effective pressure 5.5 bar. The engine makes 120 explosions per minute. Determine the mechanical efficiency of the engine, if the engine BP is 5 kW.　　　06

8. The following data refers to a four stroke diesel engine, speed 300 rpm cylinder diameter 200 mm, stroke 300 mm, effective brake load 500 kg,　　circumference of the brake drum 400 mm, mean effective pressure 6 bar. Diesel oil consumption 0.1 litres/min, specific gravity of diesel 0.78,　　calorific value of oil = 43900 kJ/kg.

    Determine : i) Brake power　　　ii) Indicated power　　　iii) Frictional power　　　10

9. 　　a) Define : (i) Conduction (ii) Radiation.　　　　03

    b) Heat is conducted through a wall of room made of composite plate with a conduction of 134 W/mK and 60 W/mK and thickness 36 mm and 42 mm respectively. The temperature at the outer face is 96 0C and 8 0C. Determine the temperature at the interface of the two materials.　　　　07

10. 　　a) Explain closed cycle gas turbine with schematic diagram.　　　　06

    b) State the applications and limitations of gas turbine　　　　04

Diploma in Mechanical Engineering
IV Semester
Course title: MECHANICS OF MACHINES
BASIC THERMAL ENGINEERING

CO1:APPLY BASIC CONCEPTS, LAWS AND PRINCIPLES OF THERMODYNAMICS TO USE AND SELECT EQUIPMENTS/DEVICES/MACHINES WORKING ON THESE BASICS

REMEMBERING

1. Define the terms: (i) system (ii) boundary and (iii) surroundings.
2. Define the terms: i) Cycle (iv) Enthalpy (v) Entropy.
3. State the comparison between closed system and open system.
4. Define intensive and extensive property.
5. Define specific heat at constant pressure and specific heat at constant volume.
6. State the zeroth law and first law of thermodynamics.
7. State first law and second law of thermodynamics.
8. Define heat and work. Are these quantities a path function or point function? Explain.
9. Define the following :
    i) Quasi-static process
    ii) Internal energy
10. Define steady flow process & write steady flow energy equation with notations.

UNDERSTANDING

1. Explain open system with example.
2. Explain the closed system with example.
3. Differentiate between intensive and extensive properties of a system. Give three examples for each.
4. Derive the characteristic gas equation.
5. Establish that $C_p-C_v=R$.

APPLICATION

1. A closed system received a heat transfer of 120 kJ and delivers a work transfer of 150 kJ. Determine the change of internal energy.

2. During the compression stroke of an engine, the work done on the working substance in the engine cylinder is 80 kJ/kg and the heat rejected to the surrounding is 40 kJ/kg. Determine the change of internal energy.

3. A closed system undergoes a change in process in which 5 kJ of heat energy is supplied to the system. Determine the change in internal energy under the following conditions.
    a. i) 1 kJ of work is done on the system.   ii)1.25 kJ of work is done by the system.

4. A piston - cylinder containing air expands at a constant pressure of 150 KPa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and change in internal energy during the process C_p = 1.01 kJ/kg K and C_v = 0.72 kJ/kg K.

5. A cold storage is to be maintained at -5° while surroundings are at 35°C. The leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual C.O.P. of the refrigeration plant is one - third of an ideal plant working between the same temperatures. Determine the power required to drive the plant.

6. In a compressor, the air has an internal energy at beginning of the expansion is 200 kJ/kg and after expansion the internal energy becomes 510 kJ/kg. The work done by the air during expansion is 150 kJ/kg. Determine the heat flow.

7. Determine the coefficient of performance and heat transfer rate in a condenser of a refrigerator in kJ/hr whose refrigeration capacity is 11000 kJ/hr if the power input is 1.5 kW.

8. The net work output of a cyclic process is 45 kN-m. If the heat input is 125 kJ, determine the efficiency of the cycle.

9. One litre of hydrogen at 0°C is suddenly compressed to one-half its volume. Determine the change in temperature of the gas if the ratio of two specific heats for hydrogen is 1.4.

CO2: OUTLINE VARIOUS THERMODYNAMIC PROCESS AND ANALYZE THEM WITH RESPECT TO VARIOUS PARAMETERS

REMEMBERING

1. List out the different thermodynamic processes on gases.
2. State characteristics of throttling process

UNDERSTANDING

1. Explain reversible and irreversible process.
2. Explain free expansion process with sketch.
3. Explain throttling process
4. Construct the PV and TS diagram for i) Constant pressure process ii) Constant volume process iii) Constant temperature process.
5. Derive expression for work done in constant temperature process with PV diagram.
6. Derive expression for work done in constant entropy (Isentropic) process with PV diagram.
7. Derive an expression for work done during polytrophic process.

1. A quantity of gas occupies a space of $0.3 m^3$ at a pressure of 2 bar and a temperature of 77°C which is heated at a constant volume, until the pressure is 7 bar. Determine (i) Temperature at the end of the process (ii) mass of the gas (iii) change in internal energy and (iv) change in enthalpy during the process.
   Assume: C_p = 1.005 kJ/kg K, C_v = 0.714 kJ/kg K, R = 287 J/kg K.

2. A quantity of gas has a volume of $0.14 m^3$, pressure 1.5 bar and temperature 100°C. If the gas is compressed at a constant pressure, until its volume becomes $0.112 m^3$, determine :
   a. i)Temperature at the end of the compression ii)Work done in compressing the gas
   b. iii) Decrease in internal energy iv)Heat given out by the gas.

3. If the values of C_p = 0.984 kJ/kg K and C_v = 0.728 kJ/kg K for an ideal gas. Determine the characteristic gas constant and ratio of specific heats for the gas. If one kg of this gas is heated at constant pressure from 25°C to 200°C. Estimate the heat added, ideal work done and change in internal energy. Also Determine the pressure and final volume if the initial volume was $2 m^3$.

4. A volume of $0.5 m^3$ of gas at a pressure of 10 bar and 200°C is expanded in a cylinder to $1.2 m^3$ at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K.

5. A quantity of air has a volume of $0.4 m^3$ at a pressure of 5 bar and a temperature of 80°C. It is expanded in a cylinder at a constant temperature to a pressure of 1 bar. Determine the amount of work done by the air.

6. $0.1 m^3$ of air at a pressure of 1.5 bar is expanded isothermally to $0.5 m^3$ Determine the final pressure of the gas and heat supplied during the process.

7. 0.5 kg of gas is compressed isentropically in such a manner that the ratio of final pressure to initial pressure is 5.25. If the initial temperature is 100°C Determine; (i) work done (ii) change in internal energy. Assume: γ= 1.4 and R = 287 J/kg K.

8. One kg of gas expands reversibly and adiabatically. Its temperature during the process falls from 515K to 390K, while the volume is doubled. The gas does 92 kJ of work in this process Calculate: The value C_p and C_v

9. A gas of $0.15 m^3$ at NTP is expanded adiabatically in a cylinder to a volume of $0.3 m^3$, Determine the pressure at the end of expansion and the work during expansion. Take C_p=1.4 KJ/Kg K

10. A certain quantity of air has a volume of $0.028 m^3$ at a pressure of 1.25 bar and 25°C. It is compressed to a volume of $0.0042 m^3$ according to the law $PV^{1.3}$= C. Determine the final temperature and work done during compression. Also determine the reduction in pressure at a constant volume required to bring the air back to its original temperature.

11. A gas has a molecular mass of 26.7. The gas is compressed through a ratio of 12 according to the law $PV^{1.25}$ = C, from initial conditions of 0.9 bar and 333 K.

Assuming specific heat at constant volume C_V = 0.79 kJ/kg K. Determine per kg of mass, work done and heat flow across the cylinder walls. Gas constant and ratio of specific heat.

CO3:	UNDERSTAND THE LIMITATIONS, APPLICATIONS AND COMPARISON OF THERMODYNAMIC CYCLES BASED ON DIFFERENT PARAMETERS.

REMEMBERING

1. Define: Air standard cycle, Reversible cycle.
2. List the assumptions made in thermodynamic air standard cycle.

UNDERSTANDING

1. Give the comparison between Otto, diesel and dual combustion cycles.
2. Derive efficiency of Carnot cycle with PV diagram.
3. Derive the efficiency of Otto cycle with PV diagram.
4. With the help of P-V and T-S diagrams, derive an expression for the air standard efficiency of a diesel cycle.
5. Derive an equation for the air standard efficiency of dual cycle.
6. Explain with the help of P-V and T-S diagrams working of Carnot cycle .
7. Explain with the help of P-V and T-S diagrams working of Otto cycle.
8. Explain with the help of P-V and T-S diagrams working of Diesel cycle.
9. Explain with the help of P-V and T-S diagrams working of Dual cycle .

APPLICATION

1. A Carnot engine working between 655 K and 320 K, produces 150 kJ of work. Determine thermal efficiency and heat added during the process.
2. A Carnot engine operates with a thermal efficiency of 70%. The minimum temperature of the cycle is 30ºC. Determine the maximum temperature of the cycle.
3. An engineer claims his engine to develop 3.75 kW. On testing, the engine consumes 0.44 kg of fuel per hour having a calorific value of 42000 kJ/kg. The maximum temperature recorded in the cycle is 1400ºC and minimum is 350ºC. Determine whether the engineer is justified in his claim.
4. A Carnot cycle receives heat at 900ºC and rejects at 50ºC. Determine the efficiency of the cycle. If the cycle receives 4600 kJ of heat per minute, Determine the power developed by the engine.
5. A Carnot cycle works with isentropic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of the isothermal expansion is 0.3 m^3. If the maximum temperature and pressure is limited to 550 K and 21 bar. Determine; Minimum temperature in the cycle, Thermal efficiency of the cycle. Pressure at all salient points. Take ratio of specific heats as 1.4

6.   In an Otto cycle, the beginning and end temperatures of a isentropic compression are 316 K and 596 K respectively. Determine the air standard efficiency and the compression ratio. Take $\gamma = 1.4$.

7.   A certain quantity of air at a pressure of 1 bar and temperature 70°C is compressed reversibly and adiabatically until the pressure is 7 bar in an Otto cycle engine. 460 kJ of heat per kg of air is now added at constant volume. Determine: Compression ratio of the engine. Temperature at the end of compression. Temperature at the end of heat addition. Take for air, $C_p = 1$ kJ/kg K and $C_v = 0.707$ kJ/kg K.

8.   An Otto cycle has a cylinder diameter of 150 mm and a stroke of 225 mm. The clearance volume is 1.25×10^{-3} m^3. Calculate the air standard efficiency of the cycle. Take $\gamma = 1.4$.

9.   In an air standard Otto cycle, the compression ratio is 6.5 and the compression begins at 1 bar and 313 K. The heat added is 2520 kJ/kg. Determine: The maximum temperature and pressure of the cycle. Work done per kg of air. Cycle efficiency. Take for air $C_v = 0.713$ kJ/kg K, R = 287 J/kg K = 0.287 kJ/kg K.

10.   In an Otto cycle, air at 1 bar and 290 K is compressed isentropically until the pressure is 15 bar. The heat is added at constant volume until the pressure rises to 40 bar. Determine the air standard efficiency and work done during the cycle. Take $C_v = 0.717$ kJ/kg K and $R_u = 8.314$ kJ/kg mol K.

11.   A diesel engine with a compression ratio is 13:1 and fuel cut off ratio is at 8% of the stroke. Determine the air standard efficiency of an engine. Take, for air $\gamma = 1.4$.

12.   A diesel cycle operating with the temperatures at the beginning and end of compression are 57°C and 603°C respectively. The temperatures at the beginning and end of expansion are 1950°C and 870°C respectively. Determine the ideal efficiency of the cycle. Take $\gamma = 1.4$. If the compression ratio is 14 and the pressure at the beginning of compression is 1 bar. Determine the maximum pressure of the cycle.

13.   An ideal diesel engine has a diameter 150 mm and stroke 200 mm. The clearance volume is 10 percent of the swept volume. Determine the compression ratio and the air standard efficiency of the engine if the cut-off takes place at 6 percent of the stroke.

14.   A diesel engine has a compression ratio of 15. Heat addition at constant pressure takes place at 10% of the stroke. Determine the air standard efficiency of the engine. Take $\gamma = 1.4$ for air.

15.   The compression ratio of an ideal air standard diesel cycle is 15. The heat transfer is 1465 kJ/kg of air. Determine the pressure and temperature at the end of each process and determine the cycle efficiency, if the inlet conditions are 300 K and 1 bar. Take $\gamma = 1.4$ and $C_v = 0.712$ kJ/kg K, $C_p = 1$ kJ/kg K for air.

16.   An engine working on dual combustion cycle, has a compression ratio 10 and cut off takes place at of the stroke. If the pressure at the beginning of compression is 1 bar and maximum pressure 40 bar, determine the air standard efficiency of the cycle. Take $\gamma = 1.4$.

17.   An engine working on dual combustion cycle with cylinder diameter of 30 cm and a stroke of 42 cm. The clearance volume is 1800 cm^3 and cut off takes place at 6% of the stroke. The explosion pressure ratio is 1.4. Determine the air standard efficiency of the engine. Assume $\gamma = 1.4$ for air.

CO4: ANALYZE PERFORMANCE OF ICES BY OPERATING THEM AND OBSERVING CHANGES IN THERMODYNAMIC PROPERTIES DURING EACH STROKE OF ICES (AND BY USING THERMODYNAMIC DIAGRAMS.)

REMEMBERING

1. Define IC engine and give the classification of IC engines.
2. Define the following terms i) cylinder bore ii) swept volume iii) compression ratio.
3. Define brake power, indicated power, mechanical efficiency.
4. Define: Indicated thermal efficiency, Brake mean effective pressure, Brake thermal efficiency.
5. Define : Air standard efficiency, Volumetric efficiency, Relative efficiency

UNDERSTANDING

1. Explain with diagram internal combustion engine indicating the component parts.
2. Explain with neat diagram the working of two stroke petrol engine.
3. Explain with neat diagram the working of four stroke petrol engine.
4. Explain with neat diagram the working of two stroke Diesel engine.
5. Explain with neat diagram the working of four stroke diesel engine.
6. Explain with diagram Rope brake dynamometer
7. Explain the concept of heat balance sheet.

APPLICATION

1. A heat engine has a piston diameter of 150 mm, length of stroke   400 mm and mean effective pressure 5.5 bar. The engine makes 120   explosions per minute. Determine the mechanical efficiency of the engine, if the engine BP is 5 kW.
2. A diesel engine uses 6.5 kg of oil per hour of calorific value 30000   kJ/kg. If the BP of the engine is 22 kW and mechanical efficiency 85%.   Determine : 1) Indicated thermal efficiency, 2) Brake thermal efficiency 3) Specific fuel consumption in kg/BP/hr.
3. During the test on single cylinder diesel engine, working on the four stroke cycle and fitted with a rope brake, the following readings are taken:
        Effective diameter of brake wheel = 360 mm; Dead load on brake = 200 N;   Spring balance reading = 30 N; Speed = 450 rpm; Area of indicator diagram = 420 m^2; Length of indicator diagram = 60 mm; Spring scale = 1.1 bar per mm; Diameter of cylinder = 100 mm; Stroke = 150 mm; Quality of oil used = 0.815 kg/hr; Calorific value of oil = 42000 kJ/kg.Determine brake power, indicated power, mechanical efficiency, brake thermal efficiency and brake specific fuel consumption.

4. A test is carried out on a single cylinder four stroke petrol engine gave the following results :

> Cylinder diameter = 0.3 m; piston movement = 0.52 m; clearance volume = 0.0092 m3; explosions per minute = 110, indicated mean effective pressure = 7 bar; mass of the fuel = 28 kg/hr; calorific value of fuel = 19228 kJ/kg and take γ = 1.4 for air. Determine   :i) Indicated thermal efficiency   ii) Air standard efficiency iii) Relative efficiency.

5. The following observations were made during a test on a single cylinder 4 stroke cycle diesel engine.

Speed	-	150 rpm
Circumference of brake drum	-	920 rpm
Load on brake drum	-	150 mm
Spring balance reading	-	25 N
Area of indicated diagram-		950 mm2
Length of indicated diagram	-	60 mm
Spring constant	-	0.035 N/mm2/mm
Cylinder diameter -		80 mm
Length of stroke	-	110 mm
C.V. of fuel	-	45430 kJ/kg
Fuel consumed	-	0.85 kg/hr

6. Determine :   i) Mechanical efficiency   ii) Indicated thermal efficiency   iii) BMEP

7. A four stroke diesel engine has a cylinder bore of 150 mm and a stroke of 250 mm. The crank shaft speed is 300 rpm and fuel consumption is 1.2 kg/hr, having a calorific value of 39900 kJ/kg. The indicated mean effective pressure is 5.5 bar. If the compression ratio is 15 and cut off ratio is 1.8. Determine the relative efficiency. Assuming = 1.4 for the air.

8. A four stroke four cylinder petrol engine gave the following details:

    i. Stroke = 95 mm; Bore = 65 mm; Speed = 3000 rpm; Clearance volume = 65 cm3; Relative efficiency on brake thermal efficiency is 45%; CV of petrol is 46300 kJ/kg. Torque developed is 70 N-m. Determine i) Specific fuel consumption, ii) Brake power, iii) BMEP. Take = 1.4 and = 80%.

9. A petrol engine consumes 0.28 kg of fuel per BP-hr, calorific value of fuel is 44000 kJ/kg, mechanical efficiency is 80% and compression ratio is 5.8. Determine (a) Brake

thermal efficiency, (b) Indicated thermal efficiency, (c) air standard efficiency, (d) Relative efficiency, take = 1.4 for air.

10. An I.C. engine uses 6 kg of fuel having calorific value 44000 kJ/kg in one hour. The I.P developed is 18 kW. The temperature of 11.5 kg of cooling water was found to rise through 25 ^{0}C per minute. The temperature of 4.2 kg of exhaust gas with specific heat 1 kJ/kgK was found to rise through 220 ^{0}C. Construct heat balance sheet for the engine.

8. A gas engine working on four stroke constant volume cycle, gave the following results when loaded by friction brake during a test of an hour's duration :

Cylinder diameter 240 mm; Stroke length 480 mm; Clearance volume 445010--6 m3; Effective circumference of the brake wheel 3.86 m; Net load on brake 1260 N at overall speed of 226.7 rpm; Average explosions/min 77; mep of indicator card 7.5 bar; Gas used 13 m3/hr at 15 0C and 771 mm of Hg; Lower calorific value of gas 49350 kJ/m3 at NTP; Cooling jacket water 660 kg raised to 34.2 0C; Heat lost to exhaust gases 8%. Determine: i) IP ii) PB, iii) Indicated thermal efficiency iv) Efficiency ratio. Also Construct a heat balance sheet for the engine.

9. 31. A test on a single cylinder 4 stroke oil engine having bore 18 cm and stroke 36 cm yielded the following results : Brake torque 0.44 kN-m, MEP 7.2 bar, fuel consumption 3.5 kg/min, cooling water flow 4.5 kg/min, water temperature rise 36^{0}C, A/F ratio 25, exhaust gas temperature 415^{0}C, Room temperature 21^{0}C, Specific heat of exhaust gases 1.05 kJ/kgK, calorific value 45200 kJ/kg, speed = 286 rpm. Construct up a heat balance sheet on kJ/min basis.

CO5: CALCULATE HEAT TRANSFER FOR GIVEN HEAT TRANSFER SYSTEM

UNDERSTANDING

1. Derive an expression for heat transfer through a slab.
2. Derive an expression heat transfer through a composite wall.
3. Derive an expression for the quantity of heat flow through boiler tubes.
4. Explain with line diagram thermal conductivity and thermal resistance of a material.
5. Explain with line diagram radial heat transfer by conduction through thick cylinder.

APPLICATION

6. A boiler is made of iron plates 12 mm thick, if the temperature of the outside surface be 120 ^{0C} and that of the inner is 100 ^{0C}, Determine (i) heat transfer per hr and (ii) mass of water evaporated per hour. Assume that the area of heating surface is 5 m2. Take K for iron as 84 W/mK and latent heat of water at 100 ^{0C} is hfg = 2260 kJ/kg.
7. Heat is conducted through a wall of room made of composite plate with a conduction of 134 W/mK and 60 W/mK and thickness 36 mm and 42 mm respectively. The temperature at the outer face is 96 ^{0C} and 8 ^{0C}. Determine the temperature at the interface of the two materials.

8. A furnace wall is made up of bricks of 200 mm thick. The inner and outer surfaces of the wall have temperature of 800 ^{0C} and 200 ^{0C}. Determine the heat loss. If the outside temperature becomes 25 ^{0C}, after the furnace wall is covered with insulator of 100 mm thick, Determine the reduction in heat loss.
   a. Take Kbrick = 4.5 W/mK, Kinsulator = 0.5 W/mK.

9. Glass windows of a room have a total area of 10 m2 and the glass is 4 mm thick. Determine the quantity of heat that escapes from the room by conduction per second when the inside surfaces of windows are at 25 ^{0} and the outside surfaces at 10^{0} The value of K is 0.84 W/mK.

10. The walls of a room having the parallel layers in contact of cement, brick and wood of thickness 20 mm, 300 mm and 10 mm respectively. Determine the quantity of heat that passes through each m2 of wall per minute. If the temperature of air in contact with the wall is 5 ^{0C} and 30^{0} C inside. The values of K for cement, brick and wood are 0.294, 0.252 and 0.168 W/mK respectively.

11. Determine the rate of heat flow per square metre through the furnace wall made of 3 cm thick iron metal and covered with an insulating material of   0.4 cm thick. Take K iron = 51 W/mK and K insulator = 0.15 W/mK. The temperatures of the outside and inside surfaces of the wall are 400 ^{0} and 64 ^{0}C respectively.

CO6: IDENTIFY THE ELEMENTS OF GAS TURBINES AND PROCESSES OF JET PROPULSION SYSTEM

REMEMBERING

1. List the classification of gas turbine.
2. State the applications and limitations of gas turbine.
3. State the application of gas turbine and fuel used in gas turbine.
4. Identify the difference between the closed cycle gas turbine and a open cycle gas turbine.

UNDERSTANDING

1. Explain closed cycle gas turbine with schematic diagram.
2. Explain open cycle gas turbine with schematic diagram.
3. Explain with neat diagram closed cycle gas turbine with intercooling and reheating
4. Explain with neat diagram the turbo-jet engine.
5. Explain with neat diagram the working of Ram-jet engine.
6. Explain the working principle of rocket engine with line diagram.

	Course Title: **MACHINE TOOL TECHNOLOGY**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME43T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Applied science, Basic work Shop practice

Course Objectives:

1. Expose to the Concept and Basic Mechanics of Metal Cutting

2. Familiarise with Working Of Standard Machine Tools Such As Lathe, Shaping And planer, Milling, Grinding And Super finishing Process and other Non conventional machining practices

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand The Concept And Basic Mechanics Of Metal Cutting	*R/U/A*	1,2,3,4,5,10	**07**
CO2	Know the Working Of Standard Machine Tools Such As Lathe, Milling, Reciprocating Machine tools and demonstrate the need of such machine tools for sustainable development	*R/U/A*	1,2,3,4,10	**33**
CO3	Selection of super finishing process for an application and understand the impact of such process in environmental context	*R/A*	1,2,3,4,5,6,10	**05**
CO4	Expose and appreciate the application Un conventional machining process area and understand the impact of such process in environmental context	*U/A*	1,2,3,4,5,6,10	**07**
		Total sessions		**52**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE TOOL TECHNOLOGY	3	3	3	3	2	1	-	-	-	3
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. *Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.* *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3* *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2* *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1* *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	THEORY OF METAL CUTTING	07	05	05	05	15	10
2	LATHE AND OPERATIONS	11	05	10	15	30	21
3	RECIPROCATING MACHINE TOOLS	10	05	05	20	30	21
4	DRILLING AND MILLING MACHINES	12	10	20	10	40	28
5	SUPER FINISHING PROCESSES	05	05	-	10	15	10
6	NON CONVENTIONAL MACHINING PROCESS	07	-	05	10	15	10
	Total	52	30	45	70	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: THEORY OF METAL CUTTING   07Hrs

Introduction: Metal Removal Processes, Types Of Machine Tools – Theory Of Metal Cutting: Chip Formation, Orthogonal Cutting- Oblique Cutting- Machinability of metal. Cutting Tool-Classification of cutting tools-Single point Cutting Tool Geometry-Cutting Tool Materials, Tool Wear, Tool Life, and Cutting Fluids-Functions and properties.

UNIT II:LATHE AND OPERATIONS   10Hrs

Centre Lathe-Construction- Various Operations, Taper Turning Methods, Thread Cutting operation, Lathe Attachments& Accessories. Capstan and Turret Lathes – Automats – Single Spindle, Swiss Type, Multi Spindle Automatic lathe.

UNIT III: RECIPROCATING MACHINE TOOLS   11Hrs

Shaper -Principal parts, Classification, Specification of shaper, Shaper Mechanisms, Types-Hydraulic shaper. Cutting Speed, Feed, Depth of cut & machining time-Various shaper operations-Introduction to Planer -Principal parts and working of Double housing Planer, Principal parts of Slotter-Working of slotter

UNIT IV:DRILLING AND MILLING MACHINES   12Hrs

Drilling operations- Twist drill geometry –Radial drilling machine-Jigs and Fixtures-Definition-Need of Jigs and Fixtures Drill Jig-Locating devices. .Milling-Classification, Column and knee type milling machine - Milling cutters and classification-Fundamentals of milling processes-Milling operations. Indexing methods-Simple and compounding. Cutting speed, feed, depth of cut and machining time.

UNIT V:SUPER FINISHING PROCESSES   05Hrs

Abrasive Processes- Grinding Wheel – Specifications And Selection, Types Of Grinding Process – Cylindrical Grinding, Surface Grinding, Centre less Grinding–Super finishing process- Honing, Lapping, Super Finishing, Polishing And Buffing

UNIT VI: NON CONVENTIONAL MACHINING PROCESS   07Hrs

Unconventional Machining Process - Classification, Electron Beam Machining, Laser Beam Machining, Electric Discharge Machining, Ultrasonic Machining, Abrasive Jet Machining. Additive manufacturing-Concept – Various applications of Additive manufacturing

TEXT BOOKS

1. Rao, P.N., *Manufacturing Technology, Vol I & II*, Tata Mcgraw Hill Publishing Co., New Delhi, 1998
2. Seropekalpakjian, Steven R Schmid*Manufacturing Engineering and Technology*-Pearson Education-Delhi

REFERENCES

1. Sharma, P.C., *A Textbook Of Production Technology – Vol I And II*, S. Chand & Company Ltd., New Delhi, 1996
2. HMT – *"Production Technology",* Tata Mcgraw-Hill, 1998

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LIST OF SOFTWARE/LEARNING WEBSITES

1. www.nptel.ac.in/courses/112105126/36
2. www.youtube.com/watch?v=T5gjkYvMg8A
3. www.youtube.com/watch?v=ESKoaZtoB1E
4. www.freevideolectures.com

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Make Visit to nearest work shop ,observe the lathe and make list of real time machine components which are machined ,Submit hand written report of 500 words
2	Observe the milling machine of your polytechnic and study its specifications. List the possible milling operation can done on that machine, Submit hand written report of 500 words
3	Dismantle some important parts of drilling machine and carry servicing activities and Submit hand written report of 500 words
4	Compare various unconventional machines by collecting their broachers. Make comparative hand written report of 500 words
5	Visit nearest Machine tool work shop and map the machiningactivity of a particular component, prepare a drawing, list the sequence of operation, tools and machineries used. Submit hand written report of 500 words
6	Motivate student to take case study on particular manufacturing activity to inculcate self and continues learning, Submit hand written report of 500 words on selected case study

Course Delivery:

The course will be delivered through lectures and Power point presentations/ Video
Teachers can prepare or download ppt or Videos of different Machines usage in mechanical engineering application

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5

Directorate Of Technical Education   **Karnataka StateMECH**   **15ME43T**

Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4					

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4
				Student activities	05	Report	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**MACHINE TOOL TECHNOLOGY**	20
	Year:	Course code:15ME43T	

Name of Course coordinator : Units:__

CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	III SEM	**MACHINE TOOL TECHNOLOGY**	20
	Year: 2015-16	Course code:15ME43T	

Name of Course coordinator : Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Describe briefly the Metal removal process.	05	R	1	1,2
2	Give four examples for Orthogonal Cutting& **Oblique** Cutting.	05	U	1	1,2
3	Sketch and Explain taper turning attachment in a lathe OR Sketch and Explain the thread cutting operation in a lathe	10	A	2	1,2

Directorate Of Technical Education   Karnataka StateMECH   15ME43T

3- Semester Diploma Examination

MACHINE TOOL TECHNOLOGY

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>SIX</u> from **Part A** and any <u>SEVEN</u> from **Part B**

PART-A 6x5=30 marks

1. Give four examples for Orthogonal Cutting & Oblique Cutting
2. Explain steady rest and follower rest
3. Differentiate between capstan and turret lathe.
4. Write specification of shaper
5. Define w.r.t shaper: Cutting Speed, Feed, and Depth of cut machining time
6. Explain with sketch end milling
7. Explain Counter sinking and counter boring
8. Explain wheel truing and dressing
9. Discuss Additive manufacturing.

PART-B   7x10=70 marks

11. Explain the Process of chip formation with sketch
12. Explain the three taper turning methods with line sketch
13. Explain the important method of holding work in a lathe
14. Explain with neat sketch the working of Hydraulic shaper mechanism
15. Explain with neat sketch the working of planer.
16. Explain with sketch twist drill geometry
17. Explain with sketch Column and knee type of milling machine.
18. Explain with neat sketch cylindrical grinder
19. Sketch and explain Electric Discharge Machining
20. Describe briefly the principle of Additive manufacturing.

III Semester Diploma in Mechanical Engineering
COURSE TITLE: MACHINE TOOL TECHNOLOGY

COI: UNDERSTAND THE CONCEPT AND BASIC MECHANICS OF METAL CUTTING
LEVEL: REMEMBER
1. Describe briefly the Metal removal process.
2. State the condition that would allow continuous chips formation.
3. State the difference between orthogonal cutting & Oblique Cutting.
4. List the cutting tool materials.
5. List how tool wear can be minimised.
6. State the important characteristics of cutting tool materials.
7. List the factors to be considered for the selection of tool materials.
8. List the properties of cutting fluid.
9. List the factors affecting tool life.
10. Name five cutting Tools Material.
11. State the tool variables &machine variables affecting the machinability.
12. Give the classification of Cutting Fluids. List few examples in case.
13. Define tool wear and State the reasons for tool wear.
14. Define Tool Life.
15. Define cutting fluid. State the Function of Cutting Fluids.
16. Describe briefly the Mechanics of Metal cutting.

LEVEL: UNDERSTANDING
17. Explain orthogonal cutting.
18. Explain Oblique Cutting.
19. Give four examples for Orthogonal Cutting& **Oblique** Cutting.
20. Explain the Different type of chips.

LEVEL: APPLICATION
21. Write the classification of machine tools.
22. Outline the classification of cutting tools.
23. Write and explain Taylor's Tool Life Equation.
24. Illustrate the importance of various Single point cutting tool angles.
25. Sketch the geometry of single point cutting tool.
26. Sketch the Process of chip formation.

CO 02: KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH AS LATHE MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT
LEVEL: REMEMBER
1. List various operations that can be performed in lathe.
2. State the advantages of turret lathe over capstan lathe.

3. List the difference between capstan lathe and automats.
4. List the important method of holding work in a lathe.

LEVEL: UNDERSTANDING
5. Distinguish capstan lathe with centre   lathe.
6. Differentiate between capstan and turret lathe.
7. Differentiate between steady rest and follower rest.
8. Explain with sketch 3 jaw chuck.
9. Explain with sketch 4 jaw chuck.
10. Explain the process of cutting internal threads in a lathe.
11. Explain any Two taper turning methods with sketch.
12. Explain the thread cutting operation with sketch.
13. Explain with neat sketch lathe mandrel.
14. Explain with sketch face plate.

LEVEL: APPLICATION
15. Write the Specification Of a centre Lathe.
16. Sketch taper turning attachments.
17. Compare the applications and disadvantages of 3 jaw chuck & 4 jaw chucks
18. Sketch and explain the working of single spindle automats.
19. Sketch and explain the working of multiple spindle automats.

CO 02: KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH RECIPROCATING MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT
LEVEL: REMEMBER
1. Define w.r.t shaper: Cutting Speed, Feed, and Depth of cut machining time.
2. List the operation performed on a shaper.
3. List the various operations performed in planer.
4. List the various operations performed in slotter.

LEVEL: UNDERSTANDING
5. Differentiate between shaper and planer.
6. Classify the shapers
 ## LEVEL: APPLICATION
7. Write specification of shaper.
8. Sketch and Explain the working of slotter.
9. Sketch and Explain the working of Shaper
10. Sketch and Explain the working of Hydraulic shaper mechanism.
11. Sketch and Explain the working of Planer.

CO 02:KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH DRILLING AND MILLING MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT

LEVEL: REMEMBER

1. Define Jig and fixture.
2. State the importance of jig.
3. List the importance of fixture.
4. Describe briefly any two locating devices with sketch
5. State the advantages of up milling.
6. State the advantages of down milling.
7. Define w.r.t milling: Cutting Speed, Feed, and Depth of cut machining time.

LEVEL: UNDERSTANDING

8. Explain with sketch twist drill geometry.
9. Explain reaming and tapping process.
10. Explain Counter sinking and counter boring
11. Explain with neat sketch face milling.
12. Explain with neat sketch slab milling.
13. Differentiate between jigs and fixture.
14. Explain with neat sketch up milling and down milling process.
15. Write the classification of milling cutters.
16. Distinguish between a plain milling cutter and a side-milling cutter.

LEVEL: APPLICATION

17. Sketch and Explain the working of radial drilling machine.
18. Sketch and Explain end milling.
19. Sketch and explain drill jig.
20. Sketch Column and knee type of milling machine and label the parts

CO 03:SELECTION OF SUPER FINISHING PROCESS FOR AN APPLICATION AND UNDERSTAND THE IMPACT OF SUCH PROCESS IN ENVIRONMENTAL CONTEXT

LEVEL: REMEMBER

1. State the specification of grinding wheel.
2. How the grinding wheels are selected.
3. List various super finishing process.
4. State the advantages of centre less grinding over cylindrical grinding.
5. Describe wheel truing and dressing.

LEVEL: APPLICATION

6. Sketch and Explain the working of surface grinding.
7. Sketch and Explain the working of centre less grinding.
8. Sketch and Explain the working of cylindrical grinder.
9. Write the classification of grinding process.

CO 04: EXPOSE AND APPRECIATE THE APPLICATION NON CONVENTIONAL MACHINING PROCESS AREA AND UNDERSTAND THE IMPACT OF SUCH PROCESS IN ENVIRONMENTAL CONTEXT.

LEVEL: UNDERSTANDING

1. Describe briefly the principle of Additive manufacturing.
2. Give the classification of non conventional machining process.
3. Differentiate between AJM and ultra sonic machining.
4. Give the classification of nonconventional machining process.
5. Discuss Additive manufacturing.

 LEVEL: APPLICATION
6. Sketch and explain Ultrasonic Machining.
7. Sketch and explain Abrasive jet machining process.
8. Sketch and explain Electric Discharge Machining.
9. Sketch and explain Electron Beam Machining.
10. Sketch and explain Laser Beam Machining.

PROFESSIONAL ETHICS	Course Title: **PROFESSIONAL ETHICS & INDIAN CONSTITUTION**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: 15ME44T
	Type of Course: **Lectures, Self Study& Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Enthusiasm to learn the subject

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values.
2. To instill Moral and Social Values and Loyalty.
3. Create awareness among engineers about their social responsibilities
4. Appreciate the Ethical issues
5. To Know the Human rights and concept of women empowerment
6. To know features of our constitution.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Practice the moral values that ought to guide the Engineering profession.	*R/U*	5,6,7,8,10	**10**
CO2	Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations	*U/A*	5,7,8,10	**09**
CO3	Know the definitions of risk and safety also discover different factors that affect the perception of risk	*R/U*	5,6,7,10	**05**
CO4	Appreciate the Ethical issues and Know the code of ethics adopted in various professional body's and industries	*R/U*	5,6,7,10	**06**
CO5	Justify the need for protection of human rights and to know about concept of women empowerment	*R/U*	5,6,7,8,10	**8**
CO6	Know the successful functioning of democracy in India	*R/U*	5,6,7,9,10	**14**
			Total sessions	**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
PROFESSIONAL ETHICS & INDIAN CONSTITUTION	-	-	-	-	3	3	3	3	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	HUMAN VALUES	10	15	15	-	30	21
2	ENGINEERING ETHICS	09	10	15	-	25	17
3	SAFETY, RESPONSIBILITIES OF ENGINEERS	05	05	-	10	15	11
4	ETHICAL ISSUES IN ENGINEERING PRACTICE	06	05	05	5	15	11
5	HUMAN RIGHTS	8		15	5	20	13
6	INDIAN CONSTITUTION	14		25	15	40	27
	Total	52	35	75	35	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: HUMAN VALUES   10Hrs

Professional Ethics-Objectives of study of professional ethics-Human values- Definition of Morals and Ethics-Difference between Morality and Ethics-Values-Definition-Types of values-Definition of Integrity- Concept of Work Ethic- Service Learning- Definition Virtues-Definition-Civic Virtue-Duties and Rights - Respect for Others – Attitude and values, opinions-changing attitude-beliefs-Reliability-Living Peacefully-Means to be adopted for leaving peacefully-Caring-Sharing-Honesty-ValuingTime-Co-operation-Commitment-Empathy-Self-Confidence-Spirituality.

UNTII: ENGINEERING ETHICS   09Hrs

Engineering ethics-Definition-Approach-Senses of Engineering Ethics-variety of moral issues–Inquiry-Types-Moral dilemmas-Steps to solve dilemma-Moral autonomy –Definition-consensus & controversy –Profession-Definition–Ethical theories-Theories about right action Personality–Self control- Self-interest –Self respect.

UNITIII: SAFETY, RESPONSIBILITIES OF ENGINEERS   05Hrs

Safety and risk-definition- - assessment of safety and risk - risk benefit analysis and reducing risk –Personal risk-Public risk-Reducing risk-Voluntary Risk-Collegiality and loyalty–Authority-Types- collective bargaining -occupational crime –Responsibility of engineers–Types-Social responsibility-Professional responsibility-confidentiality-conflicts of interest-liability

UNIT IV:ETHICAL ISSUES IN ENGINEERING PRACTICE   06Hrs

Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semi conductor waste Disposal-Industrial waste disposal-Human centred environmental ethics- computer ethics –Types of issues-Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers- Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

UNIT V: HUMAN RIGHTS   8 Hrs

Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women- steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life, Women in rural areas- Status of Women in India - Constitutional Safeguards - Dowry Prohibition act 1961-Domestic violence act 2005- Sexual harassment at work place bill 2006-Human Rights of Children- Who is a child- list the Rights of the Child- Right to education--Protection of Children from Sexual Offences Act(POCSO)-2012- National Human Rights Commission- Constitution-Powers and function of the Commission-Employee rights- Provisions made-Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trade mark.

Introduction to constitution of India-Formation and Composition of the Constituent Assembly-Salient features of the Constitution-Preamble to the Indian Constitution Fundamental Rights-Fundamental Duties-Directive principles of state policy.

Parliamentary system of governance- Structure of Parliament- Lokhasabha and Rajyasabha - Functions of parliament- Legislative ,Executive, Financial Function, Powers of Loksabha and Rajya Sabha- Procedure followed in parliament in making law-Structure of union executive-Power and position of President, Vice President, Prime minister and council of ministers. Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts

Federalism in the Indian constitution, Division of Powers- Union list, State list and concurrent list, Structure of state legislation, Legislative assembly and Legislative council, Functions of state legislature, Structure of state executive-Powers and positions of Governor, ,Speaker, Deputy Speaker, Chief Minister and council of minister.

Local self government- meaning-Threetiersystem-Villagepanchayath-Talukpanchayath-Zillapanchayath-Local bodies-Municipalities and Corporations, Bruhath mahanagara Palike.
Functions of Election commission, UPSC, KPSC.

MODEL QUESTION PAPER
4- Semester Diploma Examination
PROFESSIONAL ETHICS & INDIAN CONSTITUTION   Time: **3**

Hours]   [Max Marks**: 100   Note:** *Answer*

any SIX from Part A and any SEVEN from Part B

PART-A   6x5=30 marks

1. Distinguish between 'morality' and 'ethics'

2. Explain the terms, 'Profession', 'Professional', and 'Professionalism'?

3. Name a few techniques (steps) to reduce risks?

4. List the ill effects of E waste disposal on environment?

5. Explain the role of computers as object of Unethical Acts?

6. State various provisions under 'human rights?

7. Differentiate between 'Patent' and 'Trade secret'?

8. State the function of Governor?

9. Write Note on gram panchayaths?

PART-B   7x10=70 marks

10. Illustrate the ethical aspect principle of caring or sharing, with an example?

11. Explain various actions of an engineer leading to dishonesty?

12. List the situations when moral dilemmas arise?

13. Distinguish between 'Social responsibility' and 'Professional responsibility'?

14. Explain Occupational crime?

15. Explain code of Ethics followed in Institution of Engineers?

16. Explain Sexual harassment at work place bill 2006?

17. Explain the basic structure of Parliament?

18. Explain the formation and functions of state high Court?

19. State the role of following members in Rajyasabha?:

   a) Chairman

   b) Leader of the house

   c) Opposition leader

MODEL QUESTION BANK

4th Semester

Course title: PROFESSIONAL ETHICS & INDIAN CONSTITUTION

CO1: PRACTICE THE MORAL VALUES THAT OUGHT TO GUIDE THE ENGINEERING PROFESSION.

Level-1: Remember

1. List the key trends in engineering ethics?
2. Distinguish between 'morality' and 'ethics'?
3. List different types of values and give a few examples in each?
4. List the civic virtues one should develop?
5. List the types of virtues, with an example for each
6. List the factors for one to work peacefully?
7. List different ways the honesty reflects?
8. List the benefits of empathy?

Level-2: Understand

9. Explain the term 'respect for others' with suitable example?
10. Explain what should one do or not to do live peacefully?
11. Distinguish between 'caring' and 'sharing'?
12. What are the impediments to proper co-operation?
13. Explain the factors that shape self-confidence in a person?
14. Explain two methods of developing self-confidence?
15. Illustrate the ethical aspect principle of caring or sharing, with an example?
16. Explain various actions of an engineer leading to dishonesty?
17. Explain Service Learning?

CO2: DISCOVER OF THE SET OF JUSTIFIED MORAL PRINCIPLES OF OBLIGATION, IDEALS THAT OUGHT TO BE ENDORSED BY THE ENGINEERS AND APPLY THEM TO CONCRETE SITUATIONS

Level-1: Remember
1. List the objectives of this course 'professional ethics'?
2. Define Engineering Ethics?
3. State the two approaches to Engineering ethics?
4. Define the term, 'moral dilemma'?
5. List the situations when moral dilemmas arise?
6. List the steps in confronting moral dilemma?
7. State the five characteristics of professionals?
8. State the specific virtues relating to honesty?
9. Define 'corporate responsibility'
10. Define 'corporate accountability?
11. List the skills required to handle moral problems/issues in engineering ethics?

Level-2: Understand
12. Why do people behave unethically?
13. Why and how do moral problems arise in a profession?
14. Explain the moral dilemma
15. Explain the difficulties in solving moral problems?
16. Explain the relation between autonomy and authority?
17. Highlight the principle of 'pre-conventional level' of moral development?
18. Explain the terms, 'Profession', 'Professional', and 'Professionalism'?
19. Describe the virtues fulfilled under professional responsibility?
20. What is moral integrity? Write on its significance?
21. Distinguish between causal responsibility, moral responsibility and Legal responsibility?
22. Where and how do moral problems arise in engineering practice? Justify the safety and other obligations of professional engineers?

CO3: KNOW THE DEFINITIONS OF RISK AND SAFETY ALSO DISCOVER DIFFERENT FACTORS THAT AFFECT THE PERCEPTION OF RISK

Level-1: Remember
1. Name the factors that influence the perception of risk?
2. List the factors that affect the risk acceptability?
3. Name a few techniques (steps) to reduce risks?
4. List various aspects of collegiality?
5. List factors/principles to justify 'confidentiality'?

Level-2: Understand
6. Describe 'institutional authority' with an example?
7. What is meant by Professional Responsibility?

Level-3: Application
8. Explain 'collective bargaining with example?
9. Explain briefly ''institutional authority?
10. Explain Occupational crime?

CO4: APPRECIATE THE ETHICAL ISSUES AND KNOW THE CODE OF ETHICS ADOPTED IN VARIOUS PROFESSIONAL BODY'S AND INDUSTRIES

Level-1: Remember

1. List the ill effects of E waste disposal on environment?
2. Define 'computer ethics'? List the issues in 'computer ethics'?
3. Name different types of problems in 'computer ethics'?
4. List the ethical problems by computers in workplace?

Level-2: Understand

5. Describe briefly on code of ethics?
6. What are the duties of an engineer as an experimenter, in environmental ethics?
7. How the plastic waste disposals create havocs?
8. Discuss on Industrial waste disposal creating disasters on environment?

Level-3: Application

9. Explain 'environmental ethics'?
10. Explain human centred environmental ethics?
11. Explain the role of computers as instruments?
12. Explain the role of computers as object of Unethical Acts?
13. Explain the role of engineers as managers?
14. Explain code of Ethics followed in Institution of Engineers?
15. Explain code of Indian Institute of Materials Management?

CO 5: JUSTIFY THE NEED FOR PROTECTION OF HUMAN RIGHTS AND TO KNOW ABOUT CONCEPT OF WOMEN EMPOWERMENT

Level-1: Remember

1. State various provisions under 'human rights?
2. List the features of 'international human rights?
3. State the provisions under professional rights?
4. State the features of the employee rights?
5. List the principles of *conflict resolution?*
6. List the various Special Programs for Women's Development from government?

Level-2: Understand

7. Describe briefly 'trademark'?
8. Differentiate between 'Patent' and 'Trade secret'?
9. Describe 'intellectual property rights?

Level-3: Application

10. Explain briefly the 'copyright'?
11. Explain briefly about patents?
12. Explain the concept of women empowerment?
13. Explain woman and Development?
14. Explain Dowry Prohibition act 1961?
15. Explain POCSO act 2012?
16. Explain domestic violence act 2005?
17. Explain Sexual harassment at work place bill 2006?

CO6: KNOW THE SUCCESSFUL FUNCTIONING OF DEMOCRACY IN INDIA

Level-1: Remember

1. List the function and powers of parliament?
2. State the positions and powers of the Governor?
3. State the powers and Functions of the Chief Minister?
4. State the functions of Taluk panchayaths?
5. State the functions of Zilla panchayaths?
6. List the functions of urban local bodies?
7. State the powers of the president?
8. State the functions of the president?
9. State the powers and Functions of the prime minister?

Level-2: Understand

10. Describe briefly about Indian constitution?
11. Write about structure of Parliament?
12. What are the Procedure followed in parliament in making law?
13. Describe the role of gram panchayaths in community upliftment?
14. Describe the role of: a) Chairman b) Leader of the house c) Opposition leader in Rajyasabha?
15. Describe importance of Judiciary?
16. Describe the Structure of state legislation
17. Describe the Jurisdiction of Supreme court,
18. Describe the Jurisdiction high court?

Level-3: Application

19. Explain theFormation & Composition of constituent assembly?
20. Explain preamble and its main objectives of Indian constitution?
21. Explain the fundamental Rights of Every citizen?
22. Explain the fundamental Duties of Every citizen?
23. Explain salient features of Indian constitution?
24. Explain the basic structure of Parliament?
25. Explain the composition of Lokasabha?
26. Explain the composition of Rajyasabha?
27. Explain the Directive principles of state policy?
28. Explain the Structure Of The Judiciary?
29. Explain the Powers of Rajya Sabha and Loksabha ?
30. Describe briefly about, Division of Powers- Union list, State list and concurrent list,
31. Explain the federalism in the Indian constitution ?
32. Explain the role of vice president?
33. Explain the role of State council of ministers?
34. Explain the functions of Zilla panchayaths?
35. Explain the formation and functions of Supreme Court?
36. Explain the formation and functions of state high Court?
37. Explain the formation and functions of subordinate courts?
38. Explain the formation of three tier system for local self government?

	Course Title: **HYDRAULICS AND PNEUMATIC LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME45P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Learning concepts of Hydraulics and Pneumatics

Course Objectives:

1. Exposure to the Hydraulics and field application of Fluid Power

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

Course Outcome		**CL**	**Linked Exercise**	**Linked PO**	**Teaching Hrs**
CO1	Apply Bernoulli's equations in flow experiments to determine the coefficient of discharge	U/A	1	1,2,3,8,9,10	**06**
CO2	Determine hydraulic coefficients of notches	U/A	2	1,2,3,8,9,10	**06**
CO3	Analyze, Variation in flow rates, pressure changes, and minor and major head losses for viscous flows through various diameter pipes.	U/A	3	1,2,3,8,9,10	**06**
CO4	Evaluate the performance of turbines	U/A	4,5,6	1,2,3,8,9,10	**18**
CO5	Evaluate the operation and performance of different types of pumps	U/A	7,8	1,2,3,8,9,10	**12**
CO6	Create the various fluid power circuits for an Engineering application for sustainable development in societal and environmental contexts	U/A	9,10,11, 12,13,14	1,2,3,6,8,9,10	**30**
				TOTAL HOURS	**78**

Legend: R; Remember, U: Understand A: Application

1. COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
HYDRAULICS AND PNEUMATIC LAB	3	3	3	3	3	1	-	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
A. HYDRAULICS		
1	Determination of Coefficient of discharge of Venturimeter	06
2	Determination of hydraulic coefficients of Rectangular and V-Notch and compare	06
3	Evaluate the major losses in pipes of varying diameter due to friction and interpret their results	06
4	Interpret the performance characteristics for Pelton wheel	06
5	Evaluate the performance characteristics for Kaplan turbine	06
6	Analyzethe performance characteristics for Francis turbine.	06
7	Draw the performance characteristics for Centrifugal pump and compare the same with reciprocating pump	06
8	Draw the performance characteristics for Reciprocating pump	06
B. PNEUMATICS		
9	Control of actuators by simple hydraulic circuits.	06
10	Control of actuators by simple Pneumatic circuits.	09
11	Crate and Demonstration of meter in and meter out circuit.	06
12	Demonstration of sequencing circuit.	03
13	Demonstration of pneumatic circuit for speed control of double acting cylinders.	03
14	Demonstration of pneumatic circuit for speed control of pneumatic motor..	03
	TOTAL	78

1.R.S.Khurmi, *"Fluid Mechanics and Machinery"*,S.Chand and Company, 2nd Edition, 2007.
2.*Hydraulics& Pneumatics* – Andrew Parr, Jaico Publishing House New Delhi.

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 05 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.

1	Ask the students to Study of a jet pump and submersible pump used in the fields
2	Take the students to Polytechnic machine shop; ask to observe the hydraulic circuit in shaper machine. Make the sketch and analyze its operation
3	Take the students to nearby earthmoving equipment (JCB) servicing work shop; ask to observe the hydraulic circuit installed in earthmoving equipment. Make the sketch and analyze its operation
4	Study of trouble shooting procedures of various hydraulic and pneumatic circuits
5	Study and think an oil power circuit for an application beyond the syllabus and Draw the circuit diagram , submit hand written report of 500 words
6	Study and think an pneumatic circuit for an application beyond the syllabus and Draw the circuit diagram , submit hand written report of 500 words

2. Each student should conduct different activity and no repeation should occur

Course Delivery:

1. *Prepare/Download a dynamic animation to illustrate the following:*
   • Working principle of hydraulic pumps.
   • Working principle of hydraulic valves and actuators.
   • Working of different types of hydraulic devices (applications).
   • Download the catalogue of Hydraulic devices.
   • Download the catalogue of pneumatic devices.
2. The course will be delivered through Demonstration and Shop practices

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

Dimension	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Student Score
RUBRICS FOR ACTIVITY(5 Marks)						
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3,4,5,6
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3,4,5,6
				Activity	05	Report	1,2,3,4,5,6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4,5,6
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.
3. Student suggested activities report for 5 marks
4. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

Serial no	Description	Marks
1	**Writing procedure** a)One experiment on Fluid mechanics/Machines b)One experiment on Pneumatics	05+05=10
2	**Conducting of Experiment** a)One experiment on Fluid mechanics/Machines**(Group of Five**)b) One experiment on Pneumatics (**Individual**)	10+10=20
3	**Calculation, results, Inference(Both experiments)**	15+5=20
	TOTAL	50

MODEL QUESTION PAPER

IV Semester Diploma in Mechanical Engineering
HYDRAULIC & PNEUMATICS LAB

Time: 3 **Hours**   [Max Marks**: 50]**

1. Determine the Coefficient of discharge of a Venturi meter.
2. Draw the pneumatic circuit to control   double acting cylinders by using 5/2 H.L. Valve and Demonstrate.

EQUIPMENT LIST: **Quantity: 01 Each**
1. Bench mounted Test Rig for Venturi meter
2. Bench mounted Test Rig for Notches
3. Bench mounted Test Rig for Friction through pipes
4. Bench mounted Test Rig for Centrifugal Pumps
5. Bench mounted Test Rig for Reciprocating Pumps
6. Bench mounted Test Rig for Kaplan Turbines
7. Bench mounted Test Rig for Francis Turbines
8. Bench mounted Test Rig for Pelton Wheel
9. Pneumatics Trainer Kit with all standard accessories.
10. Oil power hydraulics Trainer Kit with all standard accessories.

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **HYDRAULICS & PNEUMATICS**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME41T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Science.

Course Objectives:

1. To gain knowledge on the fundamental aspects of fluid flow physics and properties of fluid flow and selection of hydraulic machinery for relevant applications.
2. To learn various flow measurement techniques.

Course Outcomes:

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand fluid dynamics	*R/U/A*	1,2,3,10	**07**
CO2	Analyze the application of mass, momentum and energy equation in fluid flow.	*R/U/A*	1,2,3,10	**09**
CO3	Calculate and compare flow rates, pressure changes, minor and major head losses for viscous flows through pipes	*R/U/A*	1,2,3,6, 10	**06**
CO4	Evaluate the performance of Hydraulic turbines and operation and performance of centrifugal and reciprocating pumps	*U/A*	1,2,3,4,6, 10	**10**
CO5	Apply knowledge and Select, operate and maintain various hydraulic elements for a particular low cost automation application in sustainable manufacturing system and its impact on society	*R/U/A*	1,2,3,4,6, 10	**10**
CO6	Apply knowledge and Select, operate and maintain various pneumatic elements for a particular low cost automation application in sustainable manufacturing system and its impact on society.	*R/U/A*	1,2,3,4,10	**10**
			Total sessions	**52**

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks weightage	weightage (%)
			R	U	A		
1	INTRODUCTION TO HYDRAULICS	07	5	10	5	20	14
2	DYNAMICS OF FLUIDS	09	5	5	15	25	17
3	FLOW THROUGH PIPES	06	5	5	5	15	12
4	HYDRAULIC MACHINES	10	--	10	20	30	19
5	HYDRAULIC SYSTEMS	10	5	10	15	30	19
6	PNEUMATIC SYSTEMS	10	5	10	10	25	19
	Total	52	25	50	70	145	100

R-Remember; U-Understanding; A-Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHANICAL MEASUREMENTS	3	3	3	2	-	2	-	-	-	3
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.										
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.										
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3										
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2										
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1										
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.										

COURSE CONTENTS

UNITI: INTRODUCTION TO HYDRAULICS   07Hrs

Fluid- Concept and classification of fluid-Newton's law viscosity-Properties of fluid-Density, Specific gravity, Specific Weight, Specific Volume- Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility-Fluid pressure, Pressure head, Pressure intensity-Concept of absolute vacuum, gauge pressure, atmospheric Pressure-pressure,- Simple and differential manometers, Bourdon pressure gauge.

UNTII: DYNAMICS OF FLUIDS   09Hrs

Fluid flow-Types of fluid flows-Continuity equation-Bernoulli's theorem-Venturi meter–Construction, principle of working, Coefficient of discharge, Discharge through venture meter.- Orifice meter-Pitot tube – Construction, Principle of working,- hydraulic coefficients -Numerical on Bernoulli's theorem, venturi meter, orifice meter.

UNITIII: FLOW THROUGH PIPES	06Hrs

Concepts of fluid friction- Loss of head due to friction- Minor losses in pipes -Darcy's equation and Chezy's equation for frictional losses.- -Hydraulic gradient and total gradient line.- Hydraulic power transmission through pipe- Numerical to estimate Loss of head due to friction and major and minor losses- Power transmission. Concept of water hammer in pipes.

UNIT IV: HYDRAULIC MACHINES	10Hrs

Hydraulic turbines- Classification of turbine -Construction and working principle of Pelton wheel, Francis and Kaplan turbine.-Use of Penstock, Anchor Block, Surge tank and Draft tube. Concept of cavitations in turbines- Simple Numerical on Calculation of Discharge, Work done, Power, efficiency of turbine(Exclude Francis turbine)
Pumps- classification of pumps – construction and working of Centrifugal pump- Need for priming of centrifugal pump–multistage centrifugal pump. Reciprocating pump-types-construction and working- Air Vessel-Slip-Simple Numerical on Calculation of discharge, Work done, Power, efficiency of pumps-construction and working Submersible pump

UNIT V: HYDRAULIC SYSTEM	10Hrs

Hydraulic systems- layout of oil hydraulic systems-. Advantages of hydraulic systems-Components of Hydraulic systems- Pumps– Vane pump, gear pump, screw pump,-Valves – working and symbols of Pressure control valves – pressure relief valve, Direction control valves - 3/2, 5/2 valves,-Sequence valves.-Flow control valves–Actuators- Linear Actuators – Cylinders - single acting, double acting - Hydraulic motors-Accumulators-Types.

UNIT VI: PNEUMATICSYSTEM	10Hrs

Pneumatic system- General layout of pneumatic system-Advantages of pneumatic systems-Components of pneumatic system- Compressor – Reciprocating.-construction and working of FRL unit- working and symbols of-Control Valves – Pressure regulating valves, Flow Control valves, Direction Control Valves.-Actuators - Cylinders- single acting and double acting - Air motors,- piston motor-unit- - Pneumatic Symbols- ports and positions

 TEXT BOOKS

1. Bansal. R.K.,*"Fluid Mechanics and Hydraulics Machines"*, 9th Edition, LaxmiPublicationsPrivate Limited, New Delhi. 2011.
2. R.S.Khurmi, *"Fluid Mechanics and Machinery"*,S.Chand and Company, 2nd Edition, 2007.
3. *Hydraulics & Pneumatics* – Andrew Parr, Jaico Publishing House New Delhi.
4. *Hydraulic and Pneumatic Controls Understanding Made Easy*- K.S.Sundaram,-S.chand Company Delhi

REFERENCES

1. Ramamritham. S, *"Fluid Mechanics, Hydraulics and Fluid Machines"*, DhanpatRai&Sons,Delhi, 2004.
2. Kumar. K.L., *"Engineering Fluid Mechanics"*, 7th Edition, Eurasia Publishing House PrivateLimited, New Delhi, 1995.
3. P. N Modi and S. M. Seth*, "Hydraulics and Fluid Mechanics Including Hydraulics Machines"*, 19th Edition, Standard Book House, 2013
4 Bansal R. K, *"Strength of Materials"*,Laxmi Publications, New Delhi, 2012.
5. *Oil Hydraulic Systems*- Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013
6. *Hydraulic and Pneumatic Controls*- Srinivasan, R.- Vijay Nicole Imprints Private Limited, 2/e, 2008
7. *Pneumatic And Pneumatics Controls* -Understanding Made Easy - K.S.Sundaram,-S.chand Company Delhi
8. *Pneumatic Systems* - Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. www.youtube.com/watch?v=VyR8aeioQrU
2. http://www.youtube.com/watch?v=R6_q5gxf4vs
3. www.howstuffworks.com
4. . http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT- KANPUR/machine/ui/TOC.htm
5. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
6. https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5
7. http://www.youtube.com/watch?v=0p03UTgpnDU
8. http://www.youtube.com/watch?v=A3ormYVZMXE
9. http://www.youtube.com/watch?v=TjzKpke0nSU
10. http://www.youtube.com/watch?v=vl7GteLxgdQ
11. http://www.youtube.com/watch?v=cIdMNOysMGI
12. www.boschrexroth.co.in
13. http://www.automationstudio.com/
14. http://www.howstuffworks.com/search.php?terms=hydraulics
15. http://hyperphysics.phy-astr.gsu.edu/hbase/fluid.html#flucon
16. http://www.youtube.com/watch?v=FVR7AC8ExIM
17. http://www.youtube.com/watch?v=iOXRoYHdCV0
18. http://www.youtube.com/watch?v=qDinpuq4T0U
19. http://www.youtube.com/watch?v=xxoAm3X4iw0
20. www.festo.com
21. www.boschrexroth.co.in
22. www.nptel.iitm.ac.in
23. http://www.howstuffworks.com/search.php?terms=pneumatics

24. http://www.youtube.com/watch?v=MbKrIieogNc
25. http://www.youtube.com/watch?v=7JuNbHb5NrQ
26. http://www.youtube.com/watch?v=NakOoD-G0IY
27. http://www.youtube.com/watch?v=bG2mCiQgbwE
28. http://www.youtube.com/watch?v=cB3OCPqmUDQ
29. http://www.youtube.com/watch?v=5q7YasmwXCs
30. http://www.youtube.com/watch?v=a5Ebx__l5-g

Course Delivery:

- The course will be delivered through lectures and Power point presentations/ Video
- Teachers can prepare or download ppt of different topic's Hydraulic power engineering application, can prepare alternative slides.

- Prepare/Download a dynamic animation to illustrate the following:
  • Working principle of hydraulic pumps/Hydraulic devices
  • Working principle of hydraulic valves and actuators/ Pneumatic valves and actuators

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Each student will give an activity to prepare a tabulated summary for types of fluid which is available around city (Summary includes properties of fluid indicated in chapter-1)
2	List out any five pressure measuring devices available in market with its specifications and current market price.
3	Each student will give an activity to prepare a tabulated summary for types of pipes available in market. (Summary includes type, specification, size range, material, rate and applications).
4	Identify any one hydraulic pump and one prime mover available in market in a group of five students with detail specifications and current price.
5	Visit a nearby related Earth moving equipments service centre and prepare a summary of hydro-pneumatic devices used along with their specifications
6	Motivate student to take case study on Low Cost Automation to inculcate self and continuous learning

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4

5

Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student Activities	05	Activity sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	**Bloom's Category**	**% Weightage**
1	**Understanding**	**45**
2	**Applying the knowledge acquired from**	**25**
3	**Analysis**	**20**
4	**Evaluation& Creating new knowledge**	**10**

Directorate Of Technical Education   **Karnataka State**   **15ME41T MECH**

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**HYDRAULICS & PNEUMATICS**	20
	Year:		

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER

4- Semester Diploma Examination
HYDRAULICS AND PNEUMATICS

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>SIX</u> from Part A and any <u>SEVEN</u> from Part B

Part A   6x5=30 marks

1. List the different properties of the fluid.
2. Define the following
   i) Laminar flow   ii)   Turbulent flow,
   iii)Steady flow   iv)   Uniform flow
3. Identify major energy losses and minor energy losses.
4. State the applications of Hydraulics system.
5. Explain manometer and classify.
6. Classify of control valves.

7. Explain the general layout of pneumatic system.
8. The water is flowing through a pipe having diameters 200 mm and 100 mm at sections
1 and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m

above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 X 10^4 N/m^2 ,find the intensity of pressure at section 2.

9.APelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.

Part-B

10. a)Explain with neat sketch the pitot tube. 04

   b)An oil of specific gravity 0.8 is flowing through a venturi meter having inlet 06diameter 200mm and throat diameter 100mm .The oil-mercury differential manometer shows a reading of 250 mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

11.a)Indicate the factors for selection of Hydraulic turbine.   04

   b)A Pelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.

12. a)Write short on air motors.

b)Explain with neat sketch, the double-acting cylinder.

13.a)Sketch and explain the gear pump.

b)Sketch and explain the Spring loaded Accumulator.

14.a)Explain hydraulic gradient and total energy lines.

b)Find the loss of head, due to friction, in a pipe of 500 mm diameter and 1.5 kilometres long. The velocity of water in the pipe is 1m/s. Take co-efficient of friction as 0.005.

   15.a)Classify of control valves.   4

      b)Sketch and explain the 5/2 DC valve.   6

16.a) Explain the terms with units.   4

            i) Dynamic viscosity   ii)kinematic viscosity.

   b)Illustrate the relationship between different pressure with diagram. 6

17.a)Explain the continuity equation and Bernoulli's equation.   5

      b)Explain with neat sketch the working of multistage pump for high head.   5

18.a)Explain slip, negative slip and Percentage Slip of Reciprocating pump.   5

   b)Explain briefly FRL unit.

19.Distinguish between :   10.

 i) Steady flow and unsteady flow   ii) Uniform and non uniform flow

 iii) Compressible and incompressible flow   iv) Rotational and irrotational flow

MODEL QUESTION BANK

4- Semester Diploma Examination

HYDRAULICS AND PNEUMATICS

CO-1:UNDERSTAND FLUID DYNAMICS

Remembrance

1. Define the following properties:

a)Density   b) Weight density   c) Specific volume

d)Specific gravity   e) Viscosity

2. Define the following properties

a) Dynamic viscosity   b)kinematic viscosity.

c)Surface tension.

3.Define Newtonian and non Newtonian fluids

4.Defineand explain Newton's law of viscosity.

5.Describe manometer. How are they classified.

6.List the different properties of the fluid.

7.Define a)Atmospheric pressure, b)Gauge pressure   c)Absolute pressure.

Understanding

1. Explain the terms with units.

  a) Dynamic viscosity   b)kinematic viscosity.

2. Explain surface tension.

3. Explain the phenomenon of capillary tube.

4. Distinguish between ideal fluids and real fluid.

5. Distinguish between manometers and mechanical gauges and list different types

Of mechanical pressure gauges.

6.Explain manometer and classify.

Application

1 .Explain with a neat sketch explain Bourdon's tube pressure gauge.

2. Explain with a neat sketch Simple monometer.

3. Explain with a neat sketch Differential manometer.

4. Illustrate the relationship between different pressure with diagram.

5. Write different advantages and disadvantages of manometer.

CO-2:ANALYZE THE APPLICATION OF MASS, MOMENTUM AND ENERGY EQUATION IN FLUID FLOW.

Remembrance

1. Define equation of continuity.

2. Define the following
   i) Laminar flow   ii) Turbulent flow,
   iii)Steady flow   iv) Uniform flow
3. Define the following
   i) Compressible fluid   ii) Incompressible flow
4. State Bernoulli's theorem for steady flow of an incompressible fluid.
5. State the Bernoulli's theorem. Mention the assumptions made.
6. Define continuity equation and Bernoulli's equation.
7. List the different applications of Bernoulli's theorem .
8. Define hydraulics co-efficient.

   Understanding
   9. Explain equation of continuity.
10. Distinguish between :
    i) Steady flow and unsteady flow   ii) Uniform and nonuniform flow
    iii) Compressible and incompressible flow   iv) Rotational and irrotational flow
    v) Laminar and Turbulent flow
11. Explain pitot tube.
12. Explain the continuity equation and Bernoulli's equation.
   Application
13. Explain with neat sketch the pitot tube.
14. Explain the working orifice meter with neat sketch.
15. Explain the principal of venturi meter with a neat sketch.
   16. Water is flowing through a pipe of 50 mm diameter under a pressure of
       $29.43 \times 10^4 \text{N/m}^2$ and with mean velocity of 2.0m/s. Find the total head or total energy
       per unit weight of the water at a cross-section, which is 5m above the datum line.
17. A pipe through which water is flowing, is having diameters 200mm and 100mm at the
    cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 4.0m/s.
    Find the velocity head at sections 1 and 2 and also rate of discharge.
18. The water is flowing through a pipe having diameters 200 mm and 100 mm at sections 1
    and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m
    above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24×10^4
    N/m^2 ,find the intensity of pressure at section 2.
19. Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and
    upper end respectively. The intensity of pressure at the bottom end is $24.525 \times 10^4 \text{N/m}^2$
    and the pressure at the upper end is $9.81 \times 10^4 \text{ N/m}^2$.Determine the difference in datum
    head if the rate of flow through pipe is 40 lit/sec.
20. The water is flowing through a taper pipe of length 100 m having diameters 600 mm at
    the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a
    slope of   1 in 30. Find the pressure at the lower end if the pressure at the higher level is
    $19.62 \times 10^4 \text{ N/m}^2$

21. A horizontal venture meter with inlet and throat diameters 300mm and 150mm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and throat is 200mm mercury. Determine the rate of flow. Take C_d = 0.98.

22. An oil of specific gravity 0.8 is flowing through a venturi meter having inlet diameter 200mm and throat diameter 100mm .The oil-mercury differential manometer shows a reading of 250 mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

23. A horizontal venturi meter with inlet diameter 200mm and throat diameter 100mm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturi meter is 60 litres/sec. Find the reading of the oil-mercury differential manometer. Take C_d = 0.98.

24. A pipe through which water is flowing is having diameters 400mm and 200mm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is given 5.0 m/s. Find the velocity head at section 1 and 2 and also rate of discharge.

25. An oil of specific gravity 0.9 is flowing through a venturi meter having inlet diameter 200mm and throat diameter 100mm. The oil-mercury differential manometer shows a reading of 200mm. Calculate the discharge of oil through the horizontal venturi meter. Take C_d = 0.98.

26. The water is flowing through a pipe having diameters 200 mm and 150mm at section 1 and section 2 respectively. The rate of flow through pipe is 40 liters/sec. The section 1 is 6m above the datum line and section 2 is 3m above the datum. If the pressure at section 1 is $29.43 \times 10^4 \text{N/m}^2$, find the intensity of pressure at section 2.

27. A horizontal venturi meter with inlet and throat diameters 300mm and 150mm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet throat is 100mm of mercury. Determine the rate of flow. Take C_d = 0.98 .

28. The water is flowing through a taper pipe of length 50m having diameters 400mm at the upper end and 200mm at the lower end, at the rate of 60 liters/sec. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the higher level is $24.525 \times 10^4 \text{N/m}^{2.}$.

29. An orifice meter with orifice diameter 100mm is inserted in a pipe of 200mm diameter. The pressure gauges fitted upstream and downstream of orifice meter given readings of $19.62 \times 10^4 \text{ N/m}^2$ and $9.81 \times 10^4 \text{ N/m}^2$ respectively. Co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe.

30. An orifice meter with orifice diameter 150mm is inserted in a pipe of 300mm diameter. The pressure difference measured by mercury oil differential manometer on the two sides of the orifice meter gives a reading of 500mm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the co-efficient of discharge of meter = 0.64.

CO-3: CALCULATE AND COMPARE FLOW RATES, PRESSURE CHANGES, MINOR AND MAJOR HEAD LOSSES FOR VISCOUS FLOWS THROUGH PIPES

Remembrance

1. Define loss of head in pipes due to friction.
2. Identify major energy losses and minor energy losses.
3. Describe hydraulic gradient and total energy lines.
4. State Darcy's and Chezy's formula for fluid flow through pipes.
5. Describe different types of losses in fluid flow through pipes.
6. State the condition for maximum transmission of power.
7. Describe water hammer in pipes.

Understanding

8. Explain major energy losses and minor energy losses.
9. Explain hydraulic gradient and total energy lines.
10. Explain Darcy's and Chezy's formula for fluid flow through pipes.
11. Explain different types of losses in fluid flow through pipes.
12. Explain with the help of a line diagram
    a) Hydraulic gradient line
    b) Total energy line.
13. Explain the maximum efficiency of transmission of power.
14. Explain water hammer in pipes.

Applications

1. Write short notes water hammer.
2. Write short notes on power transmission through pipes.
3. Write short notes on losses of head due to friction through pipes.
4. Find the loss of head, due to friction, in a pipe of 500 mm diameter and 1.5 kilometres long. The velocity of water in the pipe is 1m/s. Take co-efficient of friction as 0.005.
5. Water is flowing through a pipe of 1500 m long with a velocity of 0.8 m/sec. What should be the diameter of the pipe, if the loss of head due to friction is 8.7m. Take f for the pipe as 0.01.
6. It was observed that the difference of heads between the two ends of a pipe 250 metres long and 300 mm diameter is 1.5 metres. Taking Darcy's coefficient as 0.01 and neglecting minor losses, calculate the discharge through the pipe.
7. A pipe of 60 metres long and 150 mm in diameter is connected to a water tank at one end and flows freely into the atmosphere at the other end. The height of water level in the tank is 2.6 metres above the centre of the pipe. The pipe is horizontal and f = 0.01. Determine the discharge through the pipe in litres/sec., if all the minor losses are to be considered.
8. A reservoir has been built 4 km away from a college campus having 5000 inhabitants. Water is to be supplied from the reservoir to the campus. It is estimated that each inhabitant will consume 200 litres of water per day, and that half of the daily supply is pumped within 10 hours. Calculate the size of the supply main, if the loss of head due to friction in pipeline is 20 m. Assume f = 0.008.
9. Find the head lost due to friction in a pipe 1 m in diameter and 1.5 km long when the water is flowing with a velocity of 1 m/sec., by using Darcy's equation with f = 0.020.
10. Water is supplied to a town of 4,00,000 inhabitants. The reservoir is 6.4 kilometres away from the town and loss of head due to friction in pipeline is measured as 1.5 m. Calculate the size of the supply main, if each inhabitant consumes 180 litres of water per day and half of the daily supply is pumped in 8 hours. Take the frictional factor for pipeline is 0.030.

11. Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4 m of water. Take the value of f = 0.009.

12. Determine the rate of flow of water through a pipe of diameter 200mm and length 50 m. When one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of the water in the tank is 4 m above the centre of the pipe. Consider all minor losses and take f = 0.009.

13. Water is flowing through a pipe of diameter 200mm with a velocity of 3 m/sec. Find the head lost due to friction for a length of 5 m if the coefficient of friction f = 0.021.

14. Find the head lost due to friction in a pipe of diameter 300mm and length 50 m, through which water is flowing at a velocity of 3 m/sec. Using i) Darcy formula for which f = 0.0026, ii) Chezy's formula for which C = 60.

15. Find the diameter of a pipe of length 2000 m when the rate of flow of water through the pipe is 200 litres/sec. and the head lost due to friction is 4 m. Take the value of C = 50 in Chezy's formulae.

16. A pipe of 300 m long with a diameter of 0.3 m is supplying water. Calculate the discharge of water through the pipe, the loss of head due to friction is 1.5 m. Take Darcy's coefficient as 0.01.

17. Calculate the discharge through a pipe of diameter 200mm when the difference of pressure head between the two ends of pipe 500 m apart is 4 m of water. Take the value of 'f' = 0.009.

18. Water flows through a pipe of 200 mm in diameter 60 m long with a velocity of 2.5 m/sec. Find the head loss due to friction by using Darcy's formula, assuming f = 0.005and by using Chezy's formula, assuming C = 55.

19. Find the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400 m. The rate of flow of water through the pipe is 300 litres/sec. Consider all losses and take the value of f = 0.008.

20. In a power station, water is available from a reservoir at a head of 75 m. If the efficiency of transmission is 60%, find the power available when 1.25 m^3 of water flows to the station in one section.

21. Find the maximum power that can be transmitted by a power station through a hydraulic pipe of 3 kilometres long and 200 mm diameter. The pressure of water at the power station is 1500 kPa. Take f = 0.01.

22. The pressure at the inlet of a pipeline is 400 kPa and the pressure drop is 200 kPa. The pipeline is 1.5 kilometre long. If 100 KW is to be transmitted over this pipeline, find the diameter of the pipe and efficiency of transmission. Take f = 0.006.

23. A town having a population of 1,20,000 is to be supplied with water from a reservoir at 5 km distance. It is stipulated that one half of the daily supply of 150 litres per head should be delivered within 8 hours. What must be the size of the pipe to furnish the supply, if the head available is 12 metres. Take C = 45 in Chezy's formula.

24. A pipe 3.2 kilometres long and of 0.9 m diameter is fitted with a nozzle of 200 mm diameter at its discharge end. Find the velocity of water through the nozzle, if the head of water is 50 m. Take f = 0.006 for the pipe.

25. A hydro-electric plant is supplied water at the rate of 500 litres/sec., under a head of 250 m through a pipeline 3.2 kilometres long and 500 mm diameter. The pipeline terminates in a nozzle, which has a diameter of 200 mm. find the power that can be transmitted, if the Darcy's coefficient for the pipe is 0.01.

26. A pipe of 75 mm diameter and 250 m long has a nozzle of 25 mm fitted at the discharge end. If the total head of the water is 48 m, find the maximum power transmitted. Take f as 0.01 for the pipe.

27. A pipe having a diameter 300 mm and length 3500 m is used for transmission of power by water. The total head available at pipe inlet is 500 m. Find the maximum power available at the outlet of the pipe, if f = 0.006.

CO-4: EVALUATE THE PERFORMANCE OF HYDRAULIC TURBINES AND OPERATION AND PERFORMANCE OF CENTRIFUGAL AND RECIPROCATING PUMPS

Understanding

1. Classify hydraulic turbine with examples.
2. Explain with the help of a line diagram the working principle of Impulse turbine.
3. Differentiate impulse with reaction turbines.
4. Explain the concept of cavitations in turbine.
5. Explain different Efficiency turbine.
6. Explain Draft tube. Mention its types.
7. Explain a)Penstock b)Anchor block
8. Explain Surge tank and mentions its function.
9. Indicate the factors for selection of Hydraulic turbine.
10. Indicate the functions of draft tube.
11. Classify the pumps.
12. Explain the priming in centrifugal pump.
13. Classify the various Reciprocating pumps.
14. Explain slip and negative slip of the pump.
15. Explain with a line diagram the working of Submersible pump.
16. Differentiate between the centrifugal pump and reciprocating pumps.
17. Explain slip, negative slip and Percentage Slip of Reciprocating pump.
18. Explain: (i) Slip (ii) Negative slip and (iii) Coefficient of discharge in reciprocating pump.

Applications

1. Explain with the help neat sketch, the working principle of Impulse turbine.
2. Show construction and the working principle of pelton wheel.
3. Explain the construction and the working of Francis turbine with a neat sketch.
4. Explain the construction and working of Kaplan turbine with a neat sketch.
5. Explain with neat sketch the following.
   a)Penstock b)Anchor Block.
6. Explain Surge tank with a neat sketch.
7. Explain surge tank with neat sketch.
8. Explain the multistage centrifugal pump with a neat sketch.

9. Explain with a neat sketch, constructional details and principle ofoperation of a centrifugal pump.
10. Explain with neat sketch the working of multistage pump for high head.
11. Explain with neat sketch the working of multistage pump for high discharge.
12. Explain with a neat sketch the construction and working of Single acting Reciprocating pump.
13. Explain with a neat sketch the construction and working of Double acting Reciprocating pump.
14. Explain with a neat sketch air vessel and its functions.
15. Write about Reciprocating pump and Mention its types.
16. Explain with a line diagram the working of Submersible pump.
17. A Pelton wheel develops 2000KW under a head of 100meters, and with an overall efficiency of 85%. Find the diameter of the nozzle, if the coefficient of velocity for the nozzle is 0.98.
18. A Pelton wheel, having semicircular buckets and working under a head of 140meters, is running at 600rpm. The discharge through the nozzleis500 litres/sec and diameter of the wheel is 600mm. Find: a) Power available at the nozzle,   b) Hydraulic efficiency of the wheel, if coefficient of velocity is 0.98.
19. A Pelton wheel, working under a head of 500 metres, produces 13000 kW at 430 r.p.m. If the efficiency of the wheel is 85%, determine a) Discharge of the turbine. b)Diameter of the wheel. c) Diameter of the nozzle. Assume suitable data.
20. In Hydro electric scheme the distance between high level reservoir at the top of the mountains and the turbine is 1.6Km and difference of their levels is 500m. The water is brought in 4 penstocks each of diameters of 0.9 metres connected to a nozzle of 200mm at the end. Find a) Power of each jet, and b) Total power available at the reservoir, taking the value of Darcy's co-efficient of friction as 0.008.
21. The Pykara power house in south India is equipped with impulse turbines of pelton type. Each turbine delivers a maximum power of 14250KW, when working under a head of 900m, and running 600rpm. Find the diameter of the jet, and the mean diameter of the wheel. Take overall efficiency of turbine as 89.2%.
22. A Pelton wheel is required to generate 3750KW under an effective head of400m. Find the total flow in litres/sec and size of the jet. Assume Generator efficiency 95%, Overall efficacy 80%, co-efficient of velocity 0.97, Speed ratio 0.46.   If the jet ratio is 10, find the mean diameter of the runner.
23. The overall efficiency of a pelton wheel is 86% when the power developed is 500KW under a head of 80m. If the coefficient of velocity for the nozzle is 0.97, find the diameter of the nozzle.
24. A pelton wheel of 1m diameter is working under a head of 150m. Find the speed of the runner, if the coefficient of velocity and velocity ratio is 0.98 and 0.47 respectively.
25. A pelton wheel producing 1350KW under a head of 80m at 300 rpm. Find the diameter of the wheel, if the speed ratio is 0.45.Take $C_V = 0.98$.

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26. A Kaplan turbine, operating under a net head of 20m, develops 20,000KW with an overall efficiency of 86%. The speed ratio is 2.0 and flow ratio is 0.6. The hub diameter of the wheel is 0.35 times the outside diameter of the wheel. Find the diameter and speed of the turbine.

27. A propeller turbine runner has an outer diameter of 4.5m and an inner diameter of 2.5m and develops 21,000KW when running at 140rpm. under a head of 20m. The hydraulic efficiency is 94% and overall efficiency is 88%. Find discharge through the turbine, and guide blade angle at inlet.

28. A Kaplan turbine working under a head of 5.5m develops 7500 KW. The speed ratio and flow ratio are 2.1 and 0.71 respectively. If the boss diameter is 1/3 of that of the runner and overall efficiency is 85%. Find the diameter of the runner and speed of the turbine.

29. A centrifugal pump delivers water at 30ltrs/sec to a height of 18m through a pipe of 90m long and 100mm diameter. If the overall efficiency of the pump is 75%, find the power required to drive the pump. Take f = 0.012.

30. A centrifugal pump delivers 60ltrs of water per sec to a tank situated at a height 20m. If the overall efficiency of the pump is 70%. Find the power required for the pump.

31. A centrifugal pump having an overall efficiency of 75% is discharging 30ltrs of water per sec through a pipe of 150mm diameter and 125m long. Calculate the power required to drive the pump, if the water is lifted through a height of 25m. Take coefficient friction as 0.01.

32. A double acting reciprocating pump as a stroke of 300mm and a piston of diameter 150mm. The delivery and suction head of 26m and 4m respectively including friction heads. If the pump is working at 60rpm, find power required to drive the pump with 80% efficiency.

33. A single acting reciprocating pump having a bore of 150mm diameter and Stroke of 300mm length discharges 200ltrs of water per minute. Neglecting losses, find
 a) Theoretical discharge in litre/minute.   b)Coefficient of dischargec)Slip of the pump.

34. A single acting reciprocating pump having cylinder diameter of 150mm and stroke 300mm is used to raise water to a total height of 30m.Find the power required to drive the pump, if the crank rotates at 60rpm.

35. A double acting reciprocating pump of plunger diameter 100mm and stroke of 250mm length is discharging water into a tank fitted 20m higher than the axis of the pump. If the pump is rotating at 45rpm, find the power required to drive the pump.

CO-5: APPLY KNOWLEDGE AND SELECT, OPERATE AND MAINTAIN VARIOUS HYDRAULIC ELEMENTS FOR A PARTICULAR LOW COST AUTOMATION APPLICATION IN SUSTAINABLE MANUFACTURING SYSTEM AND ITS IMPACT ON SOCIETY

Remembrance

1. State the advantages of Hydraulics system.
2. State the applications of Hydraulics system.
3. List the hydraulics system components.
4. Name the different types of valves used in hydraulics system.

5. Describe a)Pressure relief valve   b)Direction control valve
6. Describe   a)Flow control valve   b)Actuators
7. State the classification of control valves.
8. Describe Accumulator.

Understand
1. Give the difference between external gear pump and lobe pump.
2. Differentiate between simple pressure relief valve and pilot operated pressure relief valve.
3. Explain is flow control valve.
4. Explain the   non-return valve.
5. Classify of control valves.

Applications
1.Explain the hydraulic system with neat sketch.
2. Sketch and explain the gear pump.
3. Explain the working principle of lobe pump with neat sketch.
4. Sketch and explain the vane pump.
5. Sketch and explain the 5/2 DC valve.
6. Sketch and explain simple relief pressure valve.
7. Explain with neat sketch the pilot operated pressure relief valve.
8. Sketch and explain the pressure reducing valve.
9. Sketch and explain the non-return valve.
10. Sketch and explain the pilot operated valve.
11. Sketch and explain the pilot operated sequence valve.
17. Sketch and explain the Spring loaded Accumulator.

18. Explain with a neat sketch single acting cylinder.

19.Explain with a neat sketch double acting cylinder.

CO-6: APPLY KNOWLEDGE AND SELECT, OPERATE AND MAINTAIN VARIOUS PNEUMATIC ELEMENTS FOR A PARTICULAR LOW COST AUTOMATION APPLICATION IN SUSTAINABLE MANUFACTURING SYSTEM AND ITS IMPACT ON SOCIETY

Remembrance

1. State the applications of pneumatics.
2. State and explain the Pascal's law.

3. List the components of pneumatic system.
4. State the advantages of pneumatic system.
5. Describe are the pneumatic actuators.
6. State the applications of single-acting cylinder and double-acting cylinder.

7. List any five pneumatic symbols.

8. State the functions of FRL unit.

Understanding

1. Explain the Pascal's law.

2. Explain the pneumatic DCV with its symbolic representation.

3. Explain the pneumatic actuators.

4. Explain the general layout of pneumatic system.

5. Explain air motor.

6. Explain briefly FRL unit.

Applications

1. Sketch and explain the arrangement of pneumatic components.

2. Sketch and explain the vane compressor.

3. Explain the application of 2/2 DCV with its neat sketch.

4. Sketch and explain the 3/2 DCV.

5. What is 5/2 DCV. Explain with its neat sketch.

6. Explain with neat sketch, the single-acting cylinder.

7. Explain with neat sketch, the double-acting cylinder.

8. Explain air motor with Sketch.

9. Explain the piston motor with sketch.

10. Sketch and explain the gear motor.

11. Explain the working principle of vane motor with its neat sketch.

12. Write short on air motors.

13. Sketch the following pneumatic symbols.

a)FRL unit   b)Air motor   c)3/2 Pilot valve   d)Single acting actuator

c)Flow control valve.

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **BASIC THERMAL ENGINEERING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME42T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of basic mathematics and Applied Science

Course Objectives:

1. It is a science of energy transfer and its effect on physical properties of substances. It is based upon observations of common experiences of energy (mainly heat) transfer.
2. This course will provide an understanding of the basic principles of thermodynamics which is must for understanding of major fields of mechanical engineering system

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Apply basic concepts, laws and principles of thermodynamics to use and select equipments/devices/machines working on these basics	*R/U/A*	1,2,3,4,6,10	**10**
CO2	Outline various Thermodynamic process and analyze them with respect to various parameters	*R/U/A/An*	1,2,3,4,6,10	**10**
CO3	Understand the Limitations, applications and Comparison of Thermodynamic cycles based on different parameters.	*R/U/A*	1,2,3,4,10	**11**
CO4	Analyze performance of ICEs by operating them and observing changes in thermodynamic properties during each stroke of ICEs (and by using thermodynamic diagrams.)	*R/U/A/An*	1,2,3,4,6,10	**12**
CO5	Calculate heat transfer for given heat transfer system	*U/A*	1,2,3,4,10	**05**
CO6	Identify the elements of gas turbines and processes of Jet propulsion system	*R/U*	1,2,3,4,10	**04**
			Total sessions	**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
BASIC THERMAL ENGINEERING	3	3	3	3	-	3	-	-	-	3
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. *Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.* *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3* *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2* *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1* *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	BASIC CONCEPTS AND LAWS OF THERMODYNAMICS	10	5	5	15	25	17
2	THERMODYNAMIC PROCESSES	10	5	5	20	30	21
3	THERMODYNAMIC CYCLES	11	5	5	20	30	21
4	IC ENGINES-PERFORMANCE OF I.C ENGINES	12	5	10	20	35	24
5	HEAT TRANSFER	05	-	5	10	15	10
6	GAS TURBINE AND JET PROPULSION SYSTEMS	04	5	5	-	10	07
	Total	52	25	35	85	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: BASIC CONCEPTS AND LAWS OF THERMODYNAMICS   10 Hrs

Basic concepts-Definitions :system - boundary, surrounding, working fluid and state of a system.-thermodynamic systems – closed, open and isolated systems with examples-Properties of system- Intensive and Extensive properties with examples.-Definitions for properties like Enthalpy (H), Entropy(s) Internal energy (U)- Specific heat at constant pressure(C_p), specific heat at constant volume(C_v) for a gas-Relation between C_p &C_v , characteristic gas equation, Universal gas constant, Definitions for quasi-static work flow-Law of thermodynamics-Zeroth, first & second laws of thermodynamics- simple problems on conversion of Heat into Work and vice versa., Problems on gas equations-Steady flow energy equation (without proof)

UNTII: THERMODYNAMIC PROCESSES   10 Hrs

Thermodynamic processes,- Explain with P-V and T-S diagram the Constant pressure, Constant volume, Isothermal, Isentropic, Polytrophic, Free expansion and throttling processes & equations representing the processes- Derivation for work done for the above processes- Calculation of change in internal energy, heat supplied or rejected, change in Entropy for the above processes. Simple problems on the above processes   .

UNITIII: THERMODYNAMIC CYCLES   11Hrs

Thermodynamic cycle – reversible and irreversible cycles conditions for reversibility of a cycle-Explanation of Carnot cycle with P.V. and T-S diagrams, Air standard Efficiency - Problems on Carnot cycle-Explanation of Otto cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Otto cycle-Explanation of Diesel cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Diesel cycle.-Explanation of Dual cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on dual cycle.

UNIT IV: IC ENGINES- PERFORMANCE OF I.C ENGINES   12Hrs

IC engine -definition-classification- Terminology of IC engine - Working principle of Two Stroke petrol & Diesel engine - Working principle of Four Stroke petrol & Diesel engine. Testing of IC engines-Rope brake Dynamometer-Formulae for Brake power, Indicated power Mechanical efficiency, Indicated thermal efficiency, Brake thermal efficiency, Air standard efficiency, Relative efficiency, Volumetric efficiency-Concept of Heat balance sheet for an engine-Simple problems on testing of I.C. engines and heat balance sheet

UNIT V:HEAT TRANSFER   05Hrs

Introduction -Methods of heat transfer-- Conduction, convection and radiation -Fourier's law of heat conduction-Newton law of cooling- Stefan-Boltzmann law -Heat transfer by conduction through slab and composite wall- Heat transfer by Radiation: -Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Radial heat transfer by conduction through thick cylinder-Simple problems on above (conduction only)

UNIT VI: GAS TURBINE AND JET PROPULSION SYSTEMS   04 Hrs

Gas turbines- classification of gas turbines-Closed cycle gas turbine-Schematic diagram-explanation-Open cycle gas turbine-schematic diagram-explanation-Comparison of open cycle and closed cycle gas turbines.-Jet propulsion-Ram–jet engine ,turbojet engines and Rocket engine- principle of working & application.

📚 TEXT BOOKS AND REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Heat Engines	Pandya and Shah	Charotar Publishing House
2.	Thermodynamics and Heat power Engg.	Mathur and Mehta	Tata Mcgraw- Hill
3	A Text book of Thermal Engineering	R S Khurmi& J K Gupta	S Chand
4.	Thermal Engineering	P.L.Ballaney	Khanna.Publishers
5	Thermal Engineering	A. S. Sarao	SatyaPrakashan
6	Thermal Engineering	R K Rajput	Laxmi.Publications
7	Practical Thermodynamics	G D Rai	Khanna Publisher

LIST OF SOFTWARES/ LEARNING WEBSITES:

a. http://www.nptel.iitm.ac.in/video.php?subjectId=112105123 (IIT-B Video lectures)
b. http://www.thermofluids.net/
c. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm
d. http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html
e. http://www.youtube.com/watch?v=Xb05CaG7TsQ
f. http://www.youtube.com/watch?v=aAfBSJObd6Y
g. http://www.youtube.com/watch?v=DHUwFuHuCdw
h. http://www.youtube.com/watch?v=kJlmRT4E6R0
i. http://www.youtube.com/watch?v=GKqG6n6nAmg

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Identify and list real situations which works on: a: Zeroth law. b: First law of thermodynamics. c: Second law of thermodynamics.
2	Identify different Thermodynamic process in real situations.
3	Prepare charts of diesel, duel and gasoline cycles. Tabulate main points of differences between them.
4	Write the specifications of I.C.Engine of any two wheelers. Also Construct & explain cycle on which that I.C.Engine works.
5	*Arrange visit to any gas turbine power plant/Diesel engine power plant, study the operational features of Gas turbines/Diesel engines*

- The course will be delivered through lectures and Power point presentations/ Video

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activities sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: **The following documents to be verified by CIE verifier at the end of semester**
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year		Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		**BASIC THERMAL ENGG.**	20
	Year:		Course code:15ME42T	
Name of Course coordinator : CO's:____				Units:__

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	IVSEM	**BASIC THERMAL ENGG.**	20
	Year: 2016-17	Course code:15ME42T	

Name of Course coordinator :	Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Differentiate between intensive and extensive properties of a system. Give three examples for each.	04	U	1	1,2, 3,6, 10
2	A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200ºC is expanded in a cylinder to 1.2 m^3 at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K. **OR** A closed system undergoes a change in process in which 5 kJ of heat energy is supplied to the system. Determine the change in internal energy under the following conditions. i) 1 kJ of work is done on the system. ii) 1.25 kJ of work is done by the system.	06	A	1	1,2, 3,4, 6,10
3	Derive an expression for work done during polytrophic process.	04	U	2	1,2, 3,4, 6,10
4	One kg of gas expands reversibly and adiabatically. Its temperature during the process falls from 515K to 390K, while the volume is doubled. The gas does 92 kJ of work in this process Calculate: The value C_p and C_v **OR** A gas has a molecular mass of 26.7. The gas is compressed through a ratio of 12 according to the law $PV^{1.25}$ = C, from initial conditions of 0.9 bar and 333 K. Assuming specific heat at constant volume C_v = 0.79 kJ/kg K. Calculate per kg of mass, work done and heat flow across the cylinder walls. Gas constant and ratio of specific heat.	06	A	2	1,2, 3,4, 6,10

IV- Semester Diploma Examination

Course Title: **BASIC THERMAL ENGINEERING**

Time: **3 Hours**]   [Max   Marks**:   100**

Note: Answer any **SIX from PartA** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1.   Define the terms: (i) system (ii) boundary and (iii) surroundings.

2.   A closed system received a heat transfer of 120 kJ and delivers a work transfer of 150 kJ. Determine the change of internal energy.

3.   Derive expression for work done in constant temperature process with PV diagram.

4.   A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200ºC is expanded in a cylinder to 1.2 m^3 at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K.

5.   List the assumptions made in thermodynamic air standard cycle.

6   Define IC engine and give the classification of IC engines.

7.   Explain following terms:

  a) Volumetric efficiency b) Mechanical efficiency

8.   State and derive Fourier's law of heat conduction.

9.   State the applications and limitations of gas turbine.

PART-B

1.   a. Differentiate between intensive and extensive properties of a system. Give three examples for each.   04
      b. A cold storage is to be maintained at -5º while surroundings are at 35ºC. The leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual C.O.P. of the refrigeration plant is one - third of an ideal plant working between the same temperatures. Determine the power required to drive the plant.   06

2.   a) Prove that C_p-C_v=R   04

      b) A piston - cylinder containing air expands at a constant pressure of 150 KPa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and change in internal energy during the process C_p = 1.01 kJ/kg K and C_v = 0.72 kJ/kg K.   06

3.   a) List the thermodynamic processes on gases.   04

      b)A piston cylinder containing air expands at a constant pressure of 150 kpa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and the change in internal energy during the process. Take C_p = 1 kJ/kg K, R = 0.287 kJ/kg K.   06

4.	a. Derive an expression for work done during polytrophic process.		04

b. A gas of mass 0.56 kg is expanded adiabatically from a pressure at 8 bar to 1 bar adiabatically. Initial temperature of the gas is 200°C. Determine the work done and change in internal energy. Take C_p = 1 kJ/kg K and C_v = 0.714 kJ/kg K.		06

5.	Explain with the help of P-V and T-S diagrams working of Otto cycle and derive an expression for the air standard efficiency of it.		10

6.	A certain quantity of air at a pressure of 1 bar and temperature 70°C is compressed reversibly and adiabatically until the pressure is 7 bar in an Otto cycle engine. 460 kJ of heat per kg of air is now added at constant volume.

Determine:

i)Compression ratio of the engine.   ii)Temperature at the end of compression.

iii)Temperature at the end of heat addition.Take for air, C_P = 1 kJ/kg K and

C_V = 0.707 kJ/kg .		10

7.	a)	Compare petrol and diesel engines.		04

b) A heat engine has a piston diameter of 150 mm, length of stroke 400 mm and mean effective pressure 5.5 bar. The engine makes 120 explosions per minute. Determine the mechanical efficiency of the engine, if the engine BP is 5 kW.		06

8.	The following data refers to a four stroke diesel engine, speed 300 rpm cylinder diameter 200 mm, stroke 300 mm, effective brake load 500 kg,	circumference of the brake drum 400 mm, mean effective pressure 6 bar. Diesel oil consumption 0.1 litres/min, specific gravity of diesel 0.78,	calorific value of oil = 43900 kJ/kg.

Determine : i) Brake power	ii) Indicated power	iii) Frictional power	10

9.	a) Define : (i) Conduction (ii) Radiation.		03

b) Heat is conducted through a wall of room made of composite plate with a conduction of 134 W/mK and 60 W/mK and thickness 36 mm and 42 mm respectively. The temperature at the outer face is 96 0C and 8 0C. Determine the temperature at the interface of the two materials.		07

10.	a) Explain closed cycle gas turbine with schematic diagram.		06

b) State the applications and limitations of gas turbine		04

Diploma in Mechanical Engineering
IV Semester
Course title: MECHANICS OF MACHINES
BASIC THERMAL ENGINEERING

CO1:APPLY BASIC CONCEPTS, LAWS AND PRINCIPLES OF THERMODYNAMICS TO USE AND SELECT EQUIPMENTS/DEVICES/MACHINES WORKING ON THESE BASICS

REMEMBERING

1. Define the terms: (i) system (ii) boundary and (iii) surroundings.
2. Define the terms: i) Cycle (iv) Enthalpy (v) Entropy.
3. State the comparison between closed system and open system.
4. Define intensive and extensive property.
5. Define specific heat at constant pressure and specific heat at constant volume.
6. State the zeroth law and first law of thermodynamics.
7. State first law and second law of thermodynamics.
8. Define heat and work. Are these quantities a path function or point function? Explain.
9. Define the following :
    i)   Quasi-static process
    ii) Internal energy
10. Define steady flow process & write steady flow energy equation with notations.

UNDERSTANDING

1. Explain open system with example.
2. Explain the closed system with example.
3. Differentiate between intensive and extensive properties of a system. Give three examples for each.
4. Derive the characteristic gas equation.
5. Establish that $C_p-C_v=R$.

APPLICATION

1. A closed system received a heat transfer of 120 kJ and delivers a work transfer of 150 kJ. Determine the change of internal energy.

2. During the compression stroke of an engine, the work done on the working substance in the engine cylinder is 80 kJ/kg and the heat rejected to the surrounding is 40 kJ/kg. Determine the change of internal energy.

3. A closed system undergoes a change in process in which 5 kJ of heat energy is supplied to the system. Determine the change in internal energy under the following conditions.
    a. i) 1 kJ of work is done on the system.   ii)1.25 kJ of work is done by the system.

4. A piston - cylinder containing air expands at a constant pressure of 150 KPa from a temperature of 285 K to a temperature of 550 K. The mass of air is 0.05 kg. Determine the heat transfer, work transfer and change in internal energy during the process C_p = 1.01 kJ/kg K and C_v = 0.72 kJ/kg K.

5. A cold storage is to be maintained at -5° while surroundings are at 35°C. The leakage from the surroundings into the cold storage is estimated to be 29 kW. The actual C.O.P. of the refrigeration plant is one - third of an ideal plant working between the same temperatures. Determine the power required to drive the plant.

6. In a compressor, the air has an internal energy at beginning of the expansion is 200 kJ/kg and after expansion the internal energy becomes 510 kJ/kg. The work done by the air during expansion is 150 kJ/kg. Determine the heat flow.

7. Determine the coefficient of performance and heat transfer rate in a condenser of a refrigerator in kJ/hr whose refrigeration capacity is 11000 kJ/hr if the power input is 1.5 kW.

8. The net work output of a cyclic process is 45 kN-m. If the heat input is 125 kJ, determine the efficiency of the cycle.

9. One litre of hydrogen at 0°C is suddenly compressed to one-half its volume. Determine the change in temperature of the gas if the ratio of two specific heats for hydrogen is 1.4.

CO2: OUTLINE VARIOUS THERMODYNAMIC PROCESS AND ANALYZE THEM WITH RESPECT TO VARIOUS PARAMETERS

REMEMBERING

1. List out the different thermodynamic processes on gases.
2. State characteristics of throttling process

UNDERSTANDING

1. Explain reversible and irreversible process.
2. Explain free expansion process with sketch.
3. Explain throttling process
4. Construct the PV and TS diagram for i) Constant pressure process ii) Constant volume process iii) Constant temperature process.
5. Derive expression for work done in constant temperature process with PV diagram.
6. Derive expression for work done in constant entropy (Isentropic) process with PV diagram.
7. Derive an expression for work done during polytrophic process.

1. A quantity of gas occupies a space of $0.3m^3$ at a pressure of 2 bar and a temperature of 77°C which is heated at a constant volume, until the pressure is 7 bar. Determine (i) Temperature at the end of the process (ii) mass of the gas (iii) change in internal energy and (iv) change in enthalpy during the process.
   Assume: C_p = 1.005 kJ/kg K, Cv = 0.714 kJ/kg K, R = 287 J/kg K.

2. A quantity of gas has a volume of 0.14 m^3, pressure 1.5 bar and temperature 100°C. If the gas is compressed at a constant pressure, until its volume becomes 0.112 m^3, determine :
   a.   i)Temperature at the end of the compression ii)Work done in compressing the gas
   b.   iii) Decrease in internal energy iv)Heat given out by the gas.

3. If the values of C_p = 0.984 kJ/kg K and C_v = 0.728 kJ/kg K for an ideal gas. Determine the characteristic gas constant and ratio of specific heats for the gas. If one kg of this gas is heated at constant pressure from 25°C to 200°C. Estimate the heat added, ideal work done and change in internal energy. Also Determine the pressure and final volume if the initial volume was 2 m^3.

4. A volume of 0.5 m^3 of gas at a pressure of 10 bar and 200°C is expanded in a cylinder to 1.2 m^3 at constant pressure. Determine the amount of work done by the gas and the increase in internal energy. Assume C_p = 1.005 kJ/kg K and C_v = 0.712 kJ/kg K.

5. A quantity of air has a volume of 0.4 m^3 at a pressure of 5 bar and a temperature of 80°C. It is expanded in a cylinder at a constant temperature to a pressure of 1 bar. Determine the amount of work done by the air.

6. 0.1 m^3 of air at a pressure of 1.5 bar is expanded isothermally to 0.5 m^3 Determine the final pressure of the gas and heat supplied during the process.

7. 0.5 kg of gas is compressed isentropically in such a manner that the ratio of final pressure to initial pressure is 5.25. If the initial temperature is 100°C Determine; (i) work done (ii) change in internal energy. Assume: γ= 1.4 and R = 287 J/kg K.

8. One kg of gas expands reversibly and adiabatically. Its temperature during the process falls from 515K to 390K, while the volume is doubled. The gas does 92 kJ of work in this process Calculate: The value C_p and C_v

9. A gas of 0.15 m^3 at NTP is expanded adiabatically in a cylinder to a volume of 0.3 m^3, Determine the pressure at the end of expansion and the work during expansion. Take C_p=1.4 KJ/Kg K

10. A certain quantity of air has a volume of 0.028 m^3 at a pressure of 1.25 bar and 25°C. It is compressed to a volume of 0.0042 m^3 according to the law $PV^{1.3}$= C. Determine the final temperature and work done during compression. Also determine the reduction in pressure at a constant volume required to bring the air back to its original temperature.

11. A gas has a molecular mass of 26.7. The gas is compressed through a ratio of 12 according to the law $PV^{1.25}$ = C, from initial conditions of 0.9 bar and 333 K.

Assuming specific heat at constant volume C_V = 0.79 kJ/kg K. Determine per kg of mass, work done and heat flow across the cylinder walls. Gas constant and ratio of specific heat.

CO3:	UNDERSTAND THE LIMITATIONS, APPLICATIONS AND COMPARISON OF THERMODYNAMIC CYCLES BASED ON DIFFERENT PARAMETERS.

REMEMBERING

1. Define: Air standard cycle, Reversible cycle.
2. List the assumptions made in thermodynamic air standard cycle.

UNDERSTANDING

1. Give the comparison between Otto, diesel and dual combustion cycles.
2. Derive efficiency of Carnot cycle with PV diagram.
3. Derive the efficiency of Otto cycle with PV diagram.
4. With the help of P-V and T-S diagrams, derive an expression for the air standard efficiency of a diesel cycle.
5. Derive an equation for the air standard efficiency of dual cycle.
6. Explain with the help of P-V and T-S diagrams working of Carnot cycle .
7. Explain with the help of P-V and T-S diagrams working of Otto cycle.
8. Explain with the help of P-V and T-S diagrams working of Diesel cycle.
9. Explain with the help of P-V and T-S diagrams working of Dual cycle .

APPLICATION

1. A Carnot engine working between 655 K and 320 K, produces 150 kJ of work. Determine thermal efficiency and heat added during the process.
2. A Carnot engine operates with a thermal efficiency of 70%. The minimum temperature of the cycle is 30ºC. Determine the maximum temperature of the cycle.
3. An engineer claims his engine to develop 3.75 kW. On testing, the engine consumes 0.44 kg of fuel per hour having a calorific value of 42000 kJ/kg. The maximum temperature recorded in the cycle is 1400ºC and minimum is 350ºC. Determine whether the engineer is justified in his claim.
4. A Carnot cycle receives heat at 900ºC and rejects at 50ºC. Determine the efficiency of the cycle. If the cycle receives 4600 kJ of heat per minute, Determine the power developed by the engine.
5. A Carnot cycle works with isentropic compression ratio of 5 and isothermal expansion ratio of 2. The volume of air at the beginning of the isothermal expansion is 0.3 m^3. If the maximum temperature and pressure is limited to 550 K and 21 bar. Determine; Minimum temperature in the cycle, Thermal efficiency of the cycle. Pressure at all salient points. Take ratio of specific heats as 1.4

6. In an Otto cycle, the beginning and end temperatures of a isentropic compression are 316 K and 596 K respectively. Determine the air standard efficiency and the compression ratio. Take $\gamma = 1.4$.

7. A certain quantity of air at a pressure of 1 bar and temperature 70°C is compressed reversibly and adiabatically until the pressure is 7 bar in an Otto cycle engine. 460 kJ of heat per kg of air is now added at constant volume. Determine: Compression ratio of the engine. Temperature at the end of compression. Temperature at the end of heat addition. Take for air, $C_p = 1$ kJ/kg K and $C_v = 0.707$ kJ/kg K.

8. An Otto cycle has a cylinder diameter of 150 mm and a stroke of 225 mm. The clearance volume is 1.25×10^{-3} m^3. Calculate the air standard efficiency of the cycle. Take $\gamma = 1.4$.

9. In an air standard Otto cycle, the compression ratio is 6.5 and the compression begins at 1 bar and 313 K. The heat added is 2520 kJ/kg. Determine: The maximum temperature and pressure of the cycle. Work done per kg of air. Cycle efficiency. Take for air $C_v = 0.713$ kJ/kg K, R = 287 J/kg K = 0.287 kJ/kg K.

10. In an Otto cycle, air at 1 bar and 290 K is compressed isentropically until the pressure is 15 bar. The heat is added at constant volume until the pressure rises to 40 bar. Determine the air standard efficiency and work done during the cycle. Take $C_v = 0.717$ kJ/kg K and $R_u = 8.314$ kJ/kg mol K.

11. A diesel engine with a compression ratio is 13:1 and fuel cut off ratio is at 8% of the stroke. Determine the air standard efficiency of an engine. Take, for air $\gamma = 1.4$.

12. A diesel cycle operating with the temperatures at the beginning and end of compression are 57°C and 603°C respectively. The temperatures at the beginning and end of expansion are 1950°C and 870°C respectively. Determine the ideal efficiency of the cycle. Take $\gamma = 1.4$. If the compression ratio is 14 and the pressure at the beginning of compression is 1 bar. Determine the maximum pressure of the cycle.

13. An ideal diesel engine has a diameter 150 mm and stroke 200 mm. The clearance volume is 10 percent of the swept volume. Determine the compression ratio and the air standard efficiency of the engine if the cut-off takes place at 6 percent of the stroke.

14. A diesel engine has a compression ratio of 15. Heat addition at constant pressure takes place at 10% of the stroke. Determine the air standard efficiency of the engine. Take $\gamma = 1.4$ for air.

15. The compression ratio of an ideal air standard diesel cycle is 15. The heat transfer is 1465 kJ/kg of air. Determine the pressure and temperature at the end of each process and determine the cycle efficiency, if the inlet conditions are 300 K and 1 bar. Take $\gamma = 1.4$ and $C_v = 0.712$ kJ/kg K, $C_p = 1$ kJ/kg K for air.

16. An engine working on dual combustion cycle, has a compression ratio 10 and cut off takes place at of the stroke. If the pressure at the beginning of compression is 1 bar and maximum pressure 40 bar, determine the air standard efficiency of the cycle. Take $\gamma = 1.4$.

17.   An engine working on dual combustion cycle with cylinder diameter of 30 cm and a stroke of 42 cm. The clearance volume is 1800 cm^3 and cut off takes place at 6% of the stroke. The explosion pressure ratio is 1.4. Determine the air standard efficiency of the engine. Assume γ= 1.4 for air.

CO4: ANALYZE PERFORMANCE OF ICES BY OPERATING THEM AND OBSERVING CHANGES IN THERMODYNAMIC PROPERTIES DURING EACH STROKE OF ICES (AND BY USING THERMODYNAMIC DIAGRAMS.)

REMEMBERING

1. Define IC engine and give the classification of IC engines.
2. Define the following terms i) cylinder bore ii) swept volume iii) compression ratio.
3. Define brake power, indicated power, mechanical efficiency.
4. Define: Indicated thermal efficiency, Brake mean effective pressure, Brake thermal efficiency.
5. Define : Air standard efficiency, Volumetric efficiency, Relative efficiency

UNDERSTANDING

1. Explain with diagram internal combustion engine indicating the component parts.
2. Explain with neat diagram the working of two stroke petrol engine.
3. Explain with neat diagram the working of four stroke petrol engine.
4. Explain with neat diagram the working of two stroke Diesel engine.
5. Explain with neat diagram the working of four stroke diesel engine.
6. Explain with diagram Rope brake dynamometer
7. Explain the concept of heat balance sheet.

APPLICATION

1. A heat engine has a piston diameter of 150 mm, length of stroke   400 mm and mean effective pressure 5.5 bar. The engine makes 120   explosions per minute. Determine the mechanical efficiency of the engine, if the engine BP is 5 kW.
2. A diesel engine uses 6.5 kg of oil per hour of calorific value 30000   kJ/kg. If the BP of the engine is 22 kW and mechanical efficiency 85%.   Determine : 1) Indicated thermal efficiency, 2) Brake thermal efficiency 3) Specific fuel consumption in kg/BP/hr.
3. During the test on single cylinder diesel engine, working on the four stroke cycle and fitted with a rope brake, the following readings are taken:
        Effective diameter of brake wheel = 360 mm; Dead load on brake = 200 N;   Spring balance reading = 30 N; Speed = 450 rpm; Area of indicator diagram = 420 m^2; Length of indicator diagram = 60 mm; Spring scale = 1.1 bar per mm; Diameter of cylinder = 100 mm; Stroke = 150 mm; Quality of oil used = 0.815 kg/hr; Calorific value of oil = 42000 kJ/kg.Determine brake power, indicated power, mechanical efficiency, brake thermal efficiency and brake specific fuel consumption.

4. A test is carried out on a single cylinder four stroke petrol engine gave the following results :

Cylinder diameter = 0.3 m; piston movement = 0.52 m; clearance volume = 0.0092 m3; explosions per minute = 110, indicated mean effective pressure = 7 bar; mass of the fuel = 28 kg/hr; calorific value of fuel = 19228 kJ/kg and take γ = 1.4 for air. Determine   :i) Indicated thermal efficiency   ii) Air standard efficiency iii) Relative efficiency.

5. The following observations were made during a test on a single cylinder 4 stroke cycle diesel engine.

Speed	-	150 rpm
Circumference of brake drum	-	920 rpm
Load on brake drum	-	150 mm
Spring balance reading	-	25 N
Area of indicated diagram-		950 mm2
Length of indicated diagram	-	60 mm
Spring constant	-	0.035 N/mm2/mm
Cylinder diameter -		80 mm
Length of stroke	-	110 mm
C.V. of fuel	-	45430 kJ/kg
Fuel consumed	-	0.85 kg/hr

6. Determine :   i) Mechanical efficiency   ii) Indicated thermal efficiency   iii) BMEP

7. A four stroke diesel engine has a cylinder bore of 150 mm and a stroke of 250 mm. The crank shaft speed is 300 rpm and fuel consumption is 1.2 kg/hr, having a calorific value of 39900 kJ/kg. The indicated mean effective pressure is 5.5 bar. If the compression ratio is 15 and cut off ratio is 1.8. Determine the relative efficiency. Assuming = 1.4 for the air.

8. A four stroke four cylinder petrol engine gave the following details:

    i. Stroke = 95 mm; Bore = 65 mm; Speed = 3000 rpm; Clearance volume = 65 cm3; Relative efficiency on brake thermal efficiency is 45%; CV of petrol is 46300 kJ/kg. Torque developed is 70 N-m. Determine i) Specific fuel consumption, ii) Brake power, iii) BMEP. Take = 1.4 and = 80%.

9. A petrol engine consumes 0.28 kg of fuel per BP-hr, calorific value of fuel is 44000 kJ/kg, mechanical efficiency is 80% and compression ratio is 5.8. Determine (a) Brake

thermal efficiency, (b) Indicated thermal efficiency, (c) air standard efficiency, (d) Relative efficiency, take = 1.4 for air.

10. An I.C. engine uses 6 kg of fuel having calorific value 44000 kJ/kg in one hour. The I.P developed is 18 kW. The temperature of 11.5 kg of cooling water was found to rise through 25 ^{0}C per minute. The temperature of 4.2 kg of exhaust gas with specific heat 1 kJ/kgK was found to rise through 220 ^{0}C. Construct heat balance sheet for the engine.

8. A gas engine working on four stroke constant volume cycle, gave the following results when loaded by friction brake during a test of an hour's duration :

> Cylinder diameter 240 mm; Stroke length 480 mm; Clearance volume 445010--6 m3; Effective circumference of the brake wheel 3.86 m; Net load on brake 1260 N at overall speed of 226.7 rpm; Average explosions/min 77; mep of indicator card 7.5 bar; Gas used 13 m3/hr at 15 0C and 771 mm of Hg; Lower calorific value of gas 49350 kJ/m3 at NTP; Cooling jacket water 660 kg raised to 34.2 0C; Heat lost to exhaust gases 8%. Determine: i) IP ii) PB, iii) Indicated thermal efficiency iv) Efficiency ratio. Also Construct a heat balance sheet for the engine.

9. 31. A test on a single cylinder 4 stroke oil engine having bore 18 cm and stroke 36 cm yielded the following results : Brake torque 0.44 kN-m, MEP 7.2 bar, fuel consumption 3.5 kg/min, cooling water flow 4.5 kg/min, water temperature rise 36^{0}C, A/F ratio 25, exhaust gas temperature 415^{0}C, Room temperature 21^{0}C, Specific heat of exhaust gases 1.05 kJ/kgK, calorific value 45200 kJ/kg, speed = 286 rpm. Construct up a heat balance sheet on kJ/min basis.

CO5: CALCULATE HEAT TRANSFER FOR GIVEN HEAT TRANSFER SYSTEM

UNDERSTANDING

1. Derive an expression for heat transfer through a slab.
2. Derive an expression heat transfer through a composite wall.
3. Derive an expression for the quantity of heat flow through boiler tubes.
4. Explain with line diagram thermal conductivity and thermal resistance of a material.
5. Explain with line diagram radial heat transfer by conduction through thick cylinder.

APPLICATION

6. A boiler is made of iron plates 12 mm thick, if the temperature of the outside surface be 120 ^{0C} and that of the inner is 100 ^{0C}, Determine (i) heat transfer per hr and (ii) mass of water evaporated per hour. Assume that the area of heating surface is 5 m2. Take K for iron as 84 W/mK and latent heat of water at 100 ^{0C} is hfg = 2260 kJ/kg.
7. Heat is conducted through a wall of room made of composite plate with a conduction of 134 W/mK and 60 W/mK and thickness 36 mm and 42 mm respectively. The temperature at the outer face is 96 ^{0C} and 8 ^{0C}. Determine the temperature at the interface of the two materials.

8. A furnace wall is made up of bricks of 200 mm thick. The inner and outer surfaces of the wall have temperature of 800 ^{0C} and 200 ^{0C}. Determine the heat loss. If the outside temperature becomes 25 ^{0C}, after the furnace wall is covered with insulator of 100 mm thick, Determine the reduction in heat loss.
   a. Take Kbrick = 4.5 W/mK, Kinsulator = 0.5 W/mK.

9. Glass windows of a room have a total area of 10 m2 and the glass is 4 mm thick. Determine the quantity of heat that escapes from the room by conduction per second when the inside surfaces of windows are at 25 ^{0} and the outside surfaces at 10^{0} The value of K is 0.84 W/mK.

10. The walls of a room having the parallel layers in contact of cement, brick and wood of thickness 20 mm, 300 mm and 10 mm respectively. Determine the quantity of heat that passes through each m2 of wall per minute. If the temperature of air in contact with the wall is 5 ^{0C} and 30^{0} C inside. The values of K for cement, brick and wood are 0.294, 0.252 and 0.168 W/mK respectively.

11. Determine the rate of heat flow per square metre through the furnace wall made of 3 cm thick iron metal and covered with an insulating material of 0.4 cm thick. Take K iron = 51 W/mK and K insulator = 0.15 W/mK. The temperatures of the outside and inside surfaces of the wall are 400 ^{0} and 64 ^{0}C respectively.

CO6: IDENTIFY THE ELEMENTS OF GAS TURBINES AND PROCESSES OF JET PROPULSION SYSTEM

REMEMBERING

1. List the classification of gas turbine.
2. State the applications and limitations of gas turbine.
3. State the application of gas turbine and fuel used in gas turbine.
4. Identify the difference between the closed cycle gas turbine and a open cycle gas turbine.

UNDERSTANDING

1. Explain closed cycle gas turbine with schematic diagram.
2. Explain open cycle gas turbine with schematic diagram.
3. Explain with neat diagram closed cycle gas turbine with intercooling and reheating
4. Explain with neat diagram the turbo-jet engine.
5. Explain with neat diagram the working of Ram-jet engine.
6. Explain the working principle of rocket engine with line diagram.

	Course Title: **MACHINE TOOL TECHNOLOGY**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME43T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Applied science, Basic work Shop practice

Course Objectives:

1. Expose to the Concept and Basic Mechanics of Metal Cutting

2. Familiarise with Working Of Standard Machine Tools Such As Lathe, Shaping And planer, Milling, Grinding And Super finishing Process and other Non conventional machining practices

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand The Concept And Basic Mechanics Of Metal Cutting	*R/U/A*	1,2,3,4,5, 10	**07**
CO2	Know the Working Of Standard Machine Tools Such As Lathe, Milling, Reciprocating Machine tools and demonstrate the need of such machine tools for sustainable development	*R/U/A*	1,2,3,4,10	**33**
CO3	Selection of super finishing process for an application and understand the impact of such process in environmental context	*R/A*	1,2,3,4,5,6, 10	**05**
CO4	Expose and appreciate the application Un conventional machining process area and understand the impact of such process in environmental context	*U/A*	1,2,3,4,5,6, 10	**07**
			Total sessions	**52**

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE TOOL TECHNOLOGY	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**3**
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. *Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.* *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3* *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2* *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1* *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	THEORY OF METAL CUTTING	07	05	05	05	15	10
2	LATHE AND OPERATIONS	11	05	10	15	30	21
3	RECIPROCATING MACHINE TOOLS	10	05	05	20	30	21
4	DRILLING AND MILLING MACHINES	12	10	20	10	40	28
5	SUPER FINISHING PROCESSES	05	05	-	10	15	10
6	NON CONVENTIONAL MACHINING PROCESS	07	-	05	10	15	10
	Total	52	30	45	70	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: THEORY OF METAL CUTTING   07Hrs

Introduction: Metal Removal Processes, Types Of Machine Tools – Theory Of Metal Cutting: Chip Formation, Orthogonal Cutting- Oblique Cutting- Machinability of metal. Cutting Tool-Classification of cutting tools-Single point Cutting Tool Geometry-Cutting Tool Materials, Tool Wear, Tool Life, and Cutting Fluids-Functions and properties.

UNIT II:LATHE AND OPERATIONS   10Hrs

Centre Lathe-Construction- Various Operations, Taper Turning Methods, Thread Cutting operation, Lathe Attachments& Accessories. Capstan and Turret Lathes – Automats – Single Spindle, Swiss Type, Multi Spindle Automatic lathe.

UNIT III: RECIPROCATING MACHINE TOOLS   11Hrs

Shaper -Principal parts, Classification, Specification of shaper, Shaper Mechanisms, Types-Hydraulic shaper. Cutting Speed, Feed, Depth of cut & machining time-Various shaper operations-Introduction to Planer -Principal parts and working of Double housing Planer, Principal parts of Slotter-Working of slotter

UNIT IV:DRILLING AND MILLING MACHINES   12Hrs

Drilling operations- Twist drill geometry –Radial drilling machine-Jigs and Fixtures-Definition-Need of Jigs and Fixtures Drill Jig-Locating devices. .Milling-Classification, Column and knee type milling machine - Milling cutters and classification-Fundamentals of milling processes-Milling operations. Indexing methods-Simple and compounding. Cutting speed, feed, depth of cut and machining time.

UNIT V:SUPER FINISHING PROCESSES   05Hrs

Abrasive Processes- Grinding Wheel – Specifications And Selection, Types Of Grinding Process – Cylindrical Grinding, Surface Grinding, Centre less Grinding–Super finishing process- Honing, Lapping, Super Finishing, Polishing And Buffing

UNIT VI: NON CONVENTIONAL MACHINING PROCESS   07Hrs

Unconventional Machining Process - Classification, Electron Beam Machining, Laser Beam Machining, Electric Discharge Machining, Ultrasonic Machining, Abrasive Jet Machining. Additive manufacturing-Concept – Various applications of Additive manufacturing

TEXT BOOKS

1. Rao, P.N., *Manufacturing Technology, Vol I & II*, Tata Mcgraw Hill Publishing Co., New Delhi, 1998
2. Seropekalpakjian, Steven R Schmid*Manufacturing Engineering and Technology*-Pearson Education-Delhi

REFERENCES

1. Sharma, P.C., *A Textbook Of Production Technology – Vol I And II*, S. Chand & Company Ltd., New Delhi, 1996
2. HMT – *"Production Technology"*, Tata Mcgraw-Hill, 1998

1. www.nptel.ac.in/courses/112105126/36
2. www.youtube.com/watch?v=T5gjkYvMg8A
3. www.youtube.com/watch?v=ESKoaZtoB1E
4. www.freevideolectures.com

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Make Visit to nearest work shop ,observe the lathe and make list of real time machine components which are machined ,Submit hand written report of 500 words
2	Observe the milling machine of your polytechnic and study its specifications. List the possible milling operation can done on that machine, Submit hand written report of 500 words
3	Dismantle some important parts of drilling machine and carry servicing activities and Submit hand written report of 500 words
4	Compare various unconventional machines by collecting their broachers. Make comparative hand written report of 500 words
5	Visit nearest Machine tool work shop and map the machiningactivity of a particular component, prepare a drawing, list the sequence of operation, tools and machineries used. Submit hand written report of 500 words
6	Motivate student to take case study on particular manufacturing activity to inculcate self and continues learning, Submit hand written report of 500 words on selected case study

Course Delivery:

The course will be delivered through lectures and Power point presentations/ Video
Teachers can prepare or download ppt or Videos of different Machines usage in mechanical engineering application

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5

Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4
				Student activities	05	Report	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	**MACHINE TOOL TECHNOLOGY**	20
	Year:	Course code:15ME43T	

Name of Course coordinator :   Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	III SEM	**MACHINE TOOL TECHNOLOGY**	20
	Year: 2015-16	Course code:15ME43T	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Describe briefly the Metal removal process.	05	R	1	1,2
2	Give four examples for Orthogonal Cutting& **Oblique** Cutting.	05	U	1	1,2
3	Sketch and Explain taper turning attachment in a lathe OR Sketch and Explain the thread cutting operation in a lathe	10	A	2	1,2

MACHINE TOOL TECHNOLOGY

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>SIX</u> from **Part A** and any <u>SEVEN</u> from **Part B**

PART-A 6x5=30 marks

1. Give four examples for Orthogonal Cutting & Oblique Cutting
2. Explain steady rest and follower rest
3. Differentiate between capstan and turret lathe.
4. Write specification of shaper
5. Define w.r.t shaper: Cutting Speed, Feed, and Depth of cut machining time
6. Explain with sketch end milling
7. Explain Counter sinking and counter boring
8. Explain wheel truing and dressing
9. Discuss Additive manufacturing.

PART-B   7x10=70 marks

11. Explain the Process of chip formation with sketch
12. Explain the three taper turning methods with line sketch
13. Explain the important method of holding work in a lathe
14. Explainwith neat sketch the working of Hydraulic shaper mechanism
15. Explain with neat sketch the working of planer.
16. Explain with sketch twist drill geometry
17. Explain with sketch Column and knee type of milling machine.
18. Explain with neat sketch cylindrical grinder
19. Sketch and explain Electric Discharge Machining
20. Describe briefly the principle of Additive manufacturing.

III Semester Diploma in Mechanical Engineering
COURSE TITLE: MACHINE TOOL TECHNOLOGY

COI: UNDERSTAND THE CONCEPT AND BASIC MECHANICS OF METAL CUTTING
LEVEL: REMEMBER
1. Describe briefly the Metal removal process.
2. State the condition that would allow continuous chips formation.
3. State the difference between orthogonal cutting & Oblique Cutting.
4. List the cutting tool materials.
5. List how tool wear can be minimised.
6. State the important characteristics of cutting tool materials.
7. List the factors to be considered for the selection of tool materials.
8. List the properties of cutting fluid.
9. List the factors affecting tool life.
10. Name five cutting Tools Material.
11. State the tool variables &machine variables affecting the machinability.
12. Give the classification of Cutting Fluids. List few examples in case.
13. Define tool wear and State the reasons for tool wear.
14. Define Tool Life.
15. Define cutting fluid. State the Function of Cutting Fluids.
16. Describe briefly the Mechanics of Metal cutting.

LEVEL: UNDERSTANDING
17. Explain orthogonal cutting.
18. Explain Oblique Cutting.
19. Give four examples for Orthogonal Cutting& **Oblique** Cutting.
20. Explain the Different type of chips.

LEVEL: APPLICATION
21. Write the classification of machine tools.
22. Outline the classification of cutting tools.
23. Write and explain Taylor's Tool Life Equation.
24. Illustrate the importance of various Single point cutting tool angles.
25. Sketch the geometry of single point cutting tool.
26. Sketch the Process of chip formation.

CO 02: KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH AS LATHE MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT
LEVEL: REMEMBER
1. List various operations that can be performed in lathe.
2. State the advantages of turret lathe over capstan lathe.

3. List the difference between capstan lathe and automats.
4. List the important method of holding work in a lathe.

LEVEL: UNDERSTANDING
5. Distinguish capstan lathe with centre lathe.
6. Differentiate between capstan and turret lathe.
7. Differentiate between steady rest and follower rest.
8. Explain with sketch 3 jaw chuck.
9. Explain with sketch 4 jaw chuck.
10. Explain the process of cutting internal threads in a lathe.
11. Explain any Two taper turning methods with sketch.
12. Explain the thread cutting operation with sketch.
13. Explain with neat sketch lathe mandrel.
14. Explain with sketch face plate.

LEVEL: APPLICATION
15. Write the Specification Of a centre Lathe.
16. Sketch taper turning attachments.
17. Compare the applications and disadvantages of 3 jaw chuck & 4 jaw chucks
18. Sketch and explain the working of single spindle automats.
19. Sketch and explain the working of multiple spindle automats.

CO 02: KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH RECIPROCATING MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT
LEVEL: REMEMBER
1. Define w.r.t shaper: Cutting Speed, Feed, and Depth of cut machining time.
2. List the operation performed on a shaper.
3. List the various operations performed in planer.
4. List the various operations performed in slotter.

LEVEL: UNDERSTANDING
5. Differentiate between shaper and planer.
6. Classify the shapers
LEVEL: APPLICATION
7. Write specification of shaper.
8. Sketch and Explain the working of slotter.
9. Sketch and Explain the working of Shaper
10. Sketch and Explain the working of Hydraulic shaper mechanism.
11. Sketch and Explain the working of Planer.

CO 02:KNOW THE WORKING OF STANDARD MACHINE TOOLS SUCH DRILLING AND MILLING MACHINE TOOLSAND DEMONSTRATE THE NEED OF SUCH MACHINE TOOLS FOR SUSTAINABLE DEVELOPMENT

LEVEL: REMEMBER
1. Define Jig and fixture.
2. State the importance of jig.
3. List the importance of fixture.
4. Describe briefly any two locating devices with sketch
5. State the advantages of up milling.
6. State the advantages of down milling.
7. Define w.r.t milling: Cutting Speed, Feed, and Depth of cut machining time.

LEVEL: UNDERSTANDING
8. Explain with sketch twist drill geometry.
9. Explain reaming and tapping process.
10. Explain Counter sinking and counter boring
11. Explain with neat sketch face milling.
12. Explain with neat sketch slab milling.
13. Differentiate between jigs and fixture.
14. Explain with neat sketch up milling and down milling process.
15. Write the classification of milling cutters.
16. Distinguish between a plain milling cutter and a side-milling cutter.

LEVEL: APPLICATION
17. Sketch and Explain the working of radial drilling machine.
18. Sketch and Explain end milling.
19. Sketch and explain drill jig.
20. Sketch Column and knee type of milling machine and label the parts

CO 03:SELECTION OF SUPER FINISHING PROCESS FOR AN APPLICATION AND UNDERSTAND THE IMPACT OF SUCH PROCESS IN ENVIRONMENTAL CONTEXT

LEVEL: REMEMBER
1. State the specification of grinding wheel.
2. How the grinding wheels are selected.
3. List various super finishing process.
4. State the advantages of centre less grinding over cylindrical grinding.
5. Describe wheel truing and dressing.

LEVEL: APPLICATION
6. Sketch and Explain the working of surface grinding.
7. Sketch and Explain the working of centre less grinding.
8. Sketch and Explain the working of cylindrical grinder.
9. Write the classification of grinding process.

CO 04: EXPOSE AND APPRECIATE THE APPLICATION NON CONVENTIONAL MACHINING PROCESS AREA AND UNDERSTAND THE IMPACT OF SUCH PROCESS IN ENVIRONMENTAL CONTEXT.

LEVEL: UNDERSTANDING

1. Describe briefly the principle of Additive manufacturing.
2. Give the classification of non conventional machining process.
3. Differentiate between AJM and ultra sonic machining.
4. Give the classification of nonconventional machining process.
5. Discuss Additive manufacturing.

 LEVEL: APPLICATION
6. Sketch and explain Ultrasonic Machining.
7. Sketch and explain Abrasive jet machining process.
8. Sketch and explain Electric Discharge Machining.
9. Sketch and explain Electron Beam Machining.
10. Sketch and explain Laser Beam Machining.

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

PROFESSIONAL ETHICS	Course Title: **PROFESSIONAL ETHICS & INDIAN CONSTITUTION**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: 15ME44T
	Type of Course: **Lectures, Self Study& Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Enthusiasm to learn the subject

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values.
2. To instill Moral and Social Values and Loyalty.
3. Create awareness among engineers about their social responsibilities
4. Appreciate the Ethical issues
5. To Know the Human rights and concept of women empowerment
6. To know features of our constitution.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Practice the moral values that ought to guide the Engineering profession.	*R/U*	5,6,7,8,10	**10**
CO2	Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations	*U/A*	5,7,8,10	**09**
CO3	Know the definitions of risk and safety also discover different factors that affect the perception of risk	*R/U*	5,6,7,10	**05**
CO4	Appreciate the Ethical issues and Know the code of ethics adopted in various professional body's and industries	*R/U*	5,6,7,10	**06**
CO5	Justify the need for protection of human rights and to know about concept of women empowerment	*R/U*	5,6,7,8,10	**8**
CO6	Know the successful functioning of democracy in India	*R/U*	5,6,7,9,10	**14**
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
PROFESSIONAL ETHICS & INDIAN CONSTITUTION	-	-	-	-	3	3	3	3	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	HUMAN VALUES	10	15	15	-	30	21
2	ENGINEERING ETHICS	09	10	15	-	25	17
3	SAFETY, RESPONSIBILITIES OF ENGINEERS	05	05	-	10	15	11
4	ETHICAL ISSUES IN ENGINEERING PRACTICE	06	05	05	5	15	11
5	HUMAN RIGHTS	8		15	5	20	13
6	INDIAN CONSTITUTION	14		25	15	40	27
	Total	52	35	75	35	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: HUMAN VALUES   10Hrs

Professional Ethics-Objectives of study of professional ethics-Human values- Definition of Morals and Ethics-Difference between Morality and Ethics-Values-Definition-Types of values-Definition of Integrity- Concept of Work Ethic- Service Learning- Definition Virtues-Definition-Civic Virtue-Duties and Rights - Respect for Others – Attitude and values, opinions-changing attitude-beliefs-Reliability-Living Peacefully-Means to be adopted for leaving peacefully-Caring-Sharing-Honesty-ValuingTime-Co-operation-Commitment-Empathy-Self-Confidence-Spirituality.

UNTII: ENGINEERING ETHICS   09Hrs

Engineering ethics-Definition-Approach-Senses of Engineering Ethics-variety of moral issues–Inquiry-Types-Moral dilemmas-Steps to solve dilemma-Moral autonomy –Definition-consensus & controversy –Profession-Definition–Ethical theories-Theories about right action Personality–Self control- Self-interest –Self respect.

UNITIII: SAFETY, RESPONSIBILITIES OF ENGINEERS   05Hrs

Safety and risk-definition- - assessment of safety and risk - risk benefit analysis and reducing risk –Personal risk-Public risk-Reducing risk-Voluntary Risk-Collegiality and loyalty–Authority-Types- collective bargaining -occupational crime –Responsibility of engineers–Types-Social responsibility-Professional responsibility-confidentiality-conflicts of interest-liability

UNIT IV:ETHICAL ISSUES IN ENGINEERING PRACTICE   06Hrs

Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semi conductor waste Disposal-Industrial waste disposal-Human centred environmental ethics- computer ethics –Types of issues-Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers- Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

UNIT V: HUMAN RIGHTS   8 Hrs

Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women- steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life, Women in rural areas- Status of Women in India - Constitutional Safeguards - Dowry Prohibition act 1961-Domestic violence act 2005- Sexual harassment at work place bill 2006-Human Rights of Children- Who is a child- list the Rights of the Child- Right to education--Protection of Children from Sexual Offences Act(POCSO)-2012- National Human Rights Commission- Constitution-Powers and function of the Commission-Employee rights- Provisions made-Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trade mark.

Introduction to constitution of India-Formation and Composition of the Constituent Assembly-Salient features of the Constitution-Preamble to the Indian Constitution Fundamental Rights-Fundamental Duties-Directive principles of state policy.

Parliamentary system of governance- Structure of Parliament- Lokhasabha and Rajyasabha - Functions of parliament- Legislative ,Executive, Financial Function, Powers of Loksabha and Rajya Sabha- Procedure followed in parliament in making law-Structure of union executive-Power and position of President, Vice President, Prime minister and council of ministers. Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts

Federalism in the Indian constitution, Division of Powers- Union list, State list and concurrent list, Structure of state legislation, Legislative assembly and Legislative council, Functions of state legislature, Structure of state executive-Powers and positions of Governor, ,Speaker, Deputy Speaker, Chief Minister and council of minister.

Local self government- meaning-Threetiersystem-Villagepanchayath-Talukpanchayath-Zillapanchayath-Local bodies-Municipalities and Corporations, Bruhath mahanagara Palike.

Functions of Election commission, UPSC, KPSC.

MODEL QUESTION PAPER
4- Semester Diploma Examination
PROFESSIONAL ETHICS & INDIAN CONSTITUTION   Time: **3**

Hours]   [Max Marks**: 100   Note:** *Answer*

any SIX from Part A and any SEVEN from Part B

PART-A   6x5=30 marks

1. Distinguish between 'morality' and 'ethics'

2. Explain the terms, 'Profession', 'Professional', and 'Professionalism'?

3. Name a few techniques (steps) to reduce risks?

4. List the ill effects of E waste disposal on environment?

5. Explain the role of computers as object of Unethical Acts?

6. State various provisions under 'human rights?

7. Differentiate between 'Patent' and 'Trade secret'?

8. State the function of Governor?

9. Write Note on gram panchayaths?

PART-B   7x10=70 marks

10. Illustrate the ethical aspect principle of caring or sharing, with an example?

11. Explain various actions of an engineer leading to dishonesty?

12. List the situations when moral dilemmas arise?

13. Distinguish between 'Social responsibility' and 'Professional responsibility'?

14. Explain Occupational crime?

15. Explain code of Ethics followed in Institution of Engineers?

16. Explain Sexual harassment at work place bill 2006?

17. Explain the basic structure of Parliament?

18. Explain the formation and functions of state high Court?

19. State the role of following members in Rajyasabha?:

    a) Chairman

    b) Leader of the house

    c) Opposition leader

MODEL QUESTION BANK

4th Semester

Course title: PROFESSIONAL ETHICS & INDIAN CONSTITUTION

CO1: PRACTICE THE MORAL VALUES THAT OUGHT TO GUIDE THE ENGINEERING PROFESSION.

Level-1: Remember

1. List the key trends in engineering ethics?
2. Distinguish between 'morality' and 'ethics'?
3. List different types of values and give a few examples in each?
4. List the civic virtues one should develop?
5. List the types of virtues, with an example for each
6. List the factors for one to work peacefully?
7. List different ways the honesty reflects?
8. List the benefits of empathy?

Level-2: Understand

9. Explain the term 'respect for others' with suitable example?
10. Explain what should one do or not to do live peacefully?
11. Distinguish between 'caring' and 'sharing'?
12. What are the impediments to proper co-operation?
13. Explain the factors that shape self-confidence in a person?
14. Explain two methods of developing self-confidence?
15. Illustrate the ethical aspect principle of caring or sharing, with an example?
16. Explain various actions of an engineer leading to dishonesty?
17. Explain Service Learning?

CO2: DISCOVER OF THE SET OF JUSTIFIED MORAL PRINCIPLES OF OBLIGATION, IDEALS THAT OUGHT TO BE ENDORSED BY THE ENGINEERS AND APPLY THEM TO CONCRETE SITUATIONS

Level-1: Remember

1. List the objectives of this course 'professional ethics'?
2. Define Engineering Ethics?
3. State the two approaches to Engineering ethics?
4. Define the term, 'moral dilemma'?
5. List the situations when moral dilemmas arise?
6. List the steps in confronting moral dilemma?
7. State the five characteristics of professionals?
8. State the specific virtues relating to honesty?
9. Define 'corporate responsibility'
10. Define 'corporate accountability?
11. List the skills required to handle moral problems/issues in engineering ethics?

Level-2: Understand

12. Why do people behave unethically?
13. Why and how do moral problems arise in a profession?
14. Explain the moral dilemma
15. Explain the difficulties in solving moral problems?
16. Explain the relation between autonomy and authority?
17. Highlight the principle of 'pre-conventional level' of moral development?
18. Explain the terms, 'Profession', 'Professional', and 'Professionalism'?
19. Describe the virtues fulfilled under professional responsibility?
20. What is moral integrity? Write on its significance?
21. Distinguish between causal responsibility, moral responsibility and Legal responsibility?
22. Where and how do moral problems arise in engineering practice? Justify the safety and other obligations of professional engineers?

CO3: KNOW THE DEFINITIONS OF RISK AND SAFETY ALSO DISCOVER DIFFERENT FACTORS THAT AFFECT THE PERCEPTION OF RISK

Level-1: Remember

1. Name the factors that influence the perception of risk?
2. List the factors that affect the risk acceptability?
3. Name a few techniques (steps) to reduce risks?
4. List various aspects of collegiality?
5. List factors/principles to justify 'confidentiality'?

Level-2: Understand

6. Describe 'institutional authority' with an example?
7. What is meant by Professional Responsibility?

Level-3: Application

8. Explain 'collective bargaining with example?
9. Explain briefly ''institutional authority?
10. Explain Occupational crime?

CO4: APPRECIATE THE ETHICAL ISSUES AND KNOW THE CODE OF ETHICS ADOPTED IN VARIOUS PROFESSIONAL BODY'S AND INDUSTRIES

Level-1: Remember
1. List the ill effects of E waste disposal on environment?
2. Define 'computer ethics'? List the issues in 'computer ethics'?
3. Name different types of problems in 'computer ethics'?
4. List the ethical problems by computers in workplace?

Level-2: Understand
5. Describe briefly on code of ethics?
6. What are the duties of an engineer as an experimenter, in environmental ethics?
7. How the plastic waste disposals create havocs?
8. Discuss on Industrial waste disposal creating disasters on environment?

Level-3: Application
9. Explain 'environmental ethics'?
10. Explain human centred environmental ethics?
11. Explain the role of computers as instruments?
12. Explain the role of computers as object of Unethical Acts?
13. Explain the role of engineers as managers?
14. Explain code of Ethics followed in Institution of Engineers?
15. Explain code of Indian Institute of Materials Management?

CO 5: JUSTIFY THE NEED FOR PROTECTION OF HUMAN RIGHTS AND TO KNOW ABOUT CONCEPT OF WOMEN EMPOWERMENT

Level-1: Remember
1. State various provisions under 'human rights?
2. List the features of 'international human rights?
3. State the provisions under professional rights?
4. State the features of the employee rights?
5. List the principles of *conflict resolution?*
6. List the various Special Programs for Women's Development from government?

Level-2: Understand
7. Describe briefly 'trademark'?
8. Differentiate between 'Patent' and 'Trade secret'?
9. Describe 'intellectual property rights?

Level-3: Application
10. Explain briefly the 'copyright'?
11. Explain briefly about patents?
12. Explain the concept of women empowerment?
13. Explain woman and Development?
14. Explain Dowry Prohibition act 1961?
15. Explain POCSO act 2012?
16. Explain domestic violence act 2005?
17. Explain Sexual harassment at work place bill 2006?

CO6: KNOW THE SUCCESSFUL FUNCTIONING OF DEMOCRACY IN INDIA

Level-1: Remember

1. List the function and powers of parliament?
2. State the positions and powers of the Governor?
3. State the powers and Functions of the Chief Minister?
4. State the functions of Taluk panchayaths?
5. State the functions of Zilla panchayaths?
6. List the functions of urban local bodies?
7. State the powers of the president?
8. State the functions of the president?
9. State the powers and Functions of the prime minister?
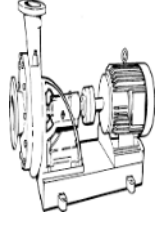
Level-2: Understand

10. Describe briefly about Indian constitution?
11. Write about structure of Parliament?
12. What are the Procedure followed in parliament in making law?
13. Describe the role of gram panchayaths in community upliftment?
14. Describe the role of: a) Chairman b) Leader of the house c) Opposition leader in Rajyasabha?
15. Describe importance of Judiciary?
16. Describe the Structure of state legislation
17. Describe the Jurisdiction of Supreme court,
18. Describe the Jurisdiction high court?

Level-3: Application

19. Explain theFormation & Composition of constituent assembly?
20. Explain preamble and its main objectives of Indian constitution?
21. Explain the fundamental Rights of Every citizen?
22. Explain the fundamental Duties of Every citizen?
23. Explain salient features of Indian constitution?
24. Explain the basic structure of Parliament?
25. Explain the composition of Lokasabha?
26. Explain the composition of Rajyasabha?
27. Explain the Directive principles of state policy?
28. Explain the Structure Of The Judiciary?
29. Explain the Powers of Rajya Sabha and Loksabha ?
30. Describe briefly about, Division of Powers- Union list, State list and concurrent list,
31. Explain the federalism in the Indian constitution ?
32. Explain the role of vice president?
33. Explain the role of State council of ministers?
34. Explain the functions of Zilla panchayaths?
35. Explain the formation and functions of Supreme Court?
36. Explain the formation and functions of state high Court?
37. Explain the formation and functions of subordinate courts?
38. Explain the formation of three tier system for local self government?

	Course Title: **HYDRAULICS AND PNEUMATIC LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME45P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Learning concepts of Hydraulics and Pneumatics

Course Objectives:

1. Exposure to the Hydraulics and field application of Fluid Power

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked Exercise**	**Linked PO**	**Teaching Hrs**
CO1	Apply Bernoulli's equations in flow experiments to determine the coefficient of discharge	U/A	1	1,2,3,8,9,10	**06**
CO2	Determine hydraulic coefficients of notches	U/A	2	1,2,3,8,9,10	**06**
CO3	Analyze, Variation in flow rates, pressure changes, and minor and major head losses for viscous flows through various diameter pipes.	U/A	3	1,2,3,8,9,10	**06**
CO4	Evaluate the performance of turbines	U/A	4,5,6	1,2,3,8,9,10	**18**
CO5	Evaluate the operation and performance of different types of pumps	U/A	7,8	1,2,3,8,9,10	**12**
CO6	Create the various fluid power circuits for an Engineering application for sustainable development in societal and environmental contexts	U/A	9,10,11, 12,13,14	1,2,3,6,8,9,10	**30**
				TOTAL HOURS	**78**

Legend: R; Remember, U: Understand A: Application

1. COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
HYDRAULICS AND PNEUMATIC LAB	3	3	3	3	3	1	-	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
A. HYDRAULICS		
1	Determination of Coefficient of discharge of Venturimeter	06
2	Determination of hydraulic coefficients of Rectangular and V-Notch and compare	06
3	Evaluate the major losses in pipes of varying diameter due to friction and interpret their results	06
4	Interpret the performance characteristics for Pelton wheel	06
5	Evaluate the performance characteristics for Kaplan turbine	06
6	Analyzethe performance characteristics for Francis turbine.	06
7	Draw the performance characteristics for Centrifugal pump and compare the same with reciprocating pump	06
8	Draw the performance characteristics for Reciprocating pump	06
B. PNEUMATICS		
9	Control of actuators by simple hydraulic circuits.	06
10	Control of actuators by simple Pneumatic circuits.	09
11	Crate and Demonstration of meter in and meter out circuit.	06
12	Demonstration of sequencing circuit.	03
13	Demonstration of pneumatic circuit for speed control of double acting cylinders.	03
14	Demonstration of pneumatic circuit for speed control of pneumatic motor..	03
	TOTAL	78

1.R.S.Khurmi, *"Fluid Mechanics and Machinery"*, S.Chand and Company, 2nd Edition, 2007.
2.*Hydraulics& Pneumatics* – Andrew Parr, Jaico Publishing House New Delhi.

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 05 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.

1	Ask the students to Study of a jet pump and submersible pump used in the fields
2	Take the students to Polytechnic machine shop; ask to observe the hydraulic circuit in shaper machine. Make the sketch and analyze its operation
3	Take the students to nearby earthmoving equipment (JCB) servicing work shop; ask to observe the hydraulic circuit installed in earthmoving equipment. Make the sketch and analyze its operation
4	Study of trouble shooting procedures of various hydraulic and pneumatic circuits
5	Study and think an oil power circuit for an application beyond the syllabus and Draw the circuit diagram , submit hand written report of 500 words
6	Study and think an pneumatic circuit for an application beyond the syllabus and Draw the circuit diagram , submit hand written report of 500 words

2. Each student should conduct different activity and no repeation should occur

Course Delivery:

1. *Prepare/Download a dynamic animation to illustrate the following:*
   • Working principle of hydraulic pumps.
   • Working principle of hydraulic valves and actuators.
   • Working of different types of hydraulic devices (applications).
   • Download the catalogue of Hydraulic devices.
   • Download the catalogue of pneumatic devices.
2. The course will be delivered through Demonstration and Shop practices

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

Dimension	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Student Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3,4,5,6
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3,4,5,6
				Activity	05	Report	1,2,3,4,5,6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4,5,6
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.
3. Student suggested activities report for 5 marks
4. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

Serial no	Description	Marks
1	**Writing procedure** a)One experiment on Fluid mechanics/Machines b)One experiment on Pneumatics	05+05=10
2	**Conducting of Experiment** a)One experiment on Fluid mechanics/Machines**(Group of Five**)b) One experiment on Pneumatics (**Individual**)	10+10=20
3	**Calculation, results, Inference(Both experiments)**	15+5=20
	TOTAL	50

MODEL QUESTION PAPER

IV Semester Diploma in Mechanical Engineering
HYDRAULIC & PNEUMATICS LAB

Time: 3 **Hours**   [Max Marks**: 50]**

1. Determine the Coefficient of discharge of a Venturi meter.
2. Draw the pneumatic circuit to control double acting cylinders by using 5/2 H.L. Valve and Demonstrate.

EQUIPMENT LIST: **Quantity: 01 Each**
   1. Bench mounted Test Rig for Venturi meter
   2. Bench mounted Test Rig for Notches
   3. Bench mounted Test Rig for Friction through pipes
   4. Bench mounted Test Rig for Centrifugal Pumps
   5. Bench mounted Test Rig for Reciprocating Pumps
   6. Bench mounted Test Rig for Kaplan Turbines
   7. Bench mounted Test Rig for Francis Turbines
   8. Bench mounted Test Rig for Pelton Wheel
   9. Pneumatics Trainer Kit with all standard accessories.
   10. Oil power hydraulics Trainer Kit with all standard accessories.

	Course Title: **MACHINE SHOP**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME46P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Theoretical concepts Machine tool Technology

Course Objectives:

1. To understand Constructional features of basic machine tools
2. To know the various Metal cutting operations and Machine tool parameters

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked Shops**	**Linked PO**	**Teaching Hrs**
CO1	Acquire skill on working of general purpose machine tools and on various manufacturing processes.	*U/A*	-	1,2,3,4,5,6,7,8,10	**24**
CO2	Create model by demonstrating various turning operation	*U/A*	Turning models exercises	1,2,3,4,5,6,7,8,10	**12**
CO3	Develop a model by demonstrating various drilling and grinding operation	*U/A*	Drilling, grinding model exercises	1,2,3,4,5,6,7,8,10	**12**
CO4	Create model by demonstrating various shaping operation	*U/A*	Shaper models exercises	1,2,3,4,5,6,7,8,10	**24**
CO5	Create model by demonstrating various Milling operation	*U/A*	Milling models exercises	1,2,3,4,5,6,7,8,10	**06**
				Total sessions	**78**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE SHOP	3	3	3	3	3	3	3	3	-	3
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. *Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.* *If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3* *If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2* *If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1* *If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.*										

COURSE CONTENT

Unit No	Unit Name	Hour
1	TURNING PRACTICE	24
2	DRILLING PRACTICE	12
3	SHAPING PRACTICE	12
4	MILLING PRACTICE	24
5	GRINDING PRACTICE	06
	Total	78

UNITI: TURNING PRACTICE   24Hrs

Demonstration and detailed explanation of Machine tools (Ordinary lathe/capstan/Turret Lathe) and work holding devices used-Description and specification of Cutting tools required for creating model–Various Turning operations performed in Machine shop-Safety practices to be observed-Clean the machine after operation

Hands on Experience
1. Turning practice on mild steel specimen to an accuracy of ± 0.25 mm.
2. Preparing at least **ONE model** involving the following operations. Plain Turning, Step Turning, Taper Turning, Knurling, Thread cutting

UNTII: DRILLING PRACTICE   12Hrs

Demonstration and detailed explanation of Machine tools (Radial drilling Machine) and work holding devices used-Description and specification of Cutting tools required for creating

model–Various Drilling operations performed in Machine shop-Safety practices to be observed-Clean the machine after operation

Hands on Experience
1. Preparation of ONE model with two or three different sizes holes for different materials at different locations

UNITIII: SHAPING PRACTICE   12Hrs

Demonstration and detailed explanation of Machine tools (Shaper) and work holding devices used-Description and specification of Cutting tools required for creating model–Various Shaping operations performed in Machine shop-Safety practices to be observed-Clean the machine after operation

Hands on Experience
1. Preparation of ONE model with Shaping step block cut dovetail to angles 60

UNITIV: MILLING PRACTICE   24 Hrs

Demonstration and detailed explanation of Machine tools (MILLING MACHINE) and work holding devices used-Selection and specification of Cutting tools required for creating model–Various Milling operations performed in Machine shop-Safety practices to be observed-Clean the machine after operation

Hands on Experience
1. Preparation of ONE model Milling-square-hexagon, Spur gear teeth, Key way from round bars with indexing and without indexing

UNITV: GRINDING PRACTICE   06Hrs

Demonstration and detailed explanation of Machine tools (Grinding) and work holding devices used-Selection and specification of Grinding wheels required for creating model–The grinding operations performed in Machine shop-Safety practices to be observed-Clean the machine after operation

Observe on Experience
1. The Grinding Single point cutting tool for required angle

Elements of Workshop Technology (Vols. 1 and II) by Hajra Chaudhary

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)
1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Instructor and Foreman with an intimation to HOD
2. Each student should conduct different activity and no repeating should occur

1	Take the students for local Machine shop observe the Machining practices followed in the industry and submit an hand written report of 500 words
2	Ask the students to observe the Various machining operations carried out in a sample

		component and submit an hand written report of 500 words					
3		Take the students for industrial visit for a nearby MSME; observe the safety practices followed and Study Various operational activities. and submit an hand written report of 500 words					

Course Delivery:
The course will be delivered through Demonstration and Shop practices

Course Assessment and Evaluation Scheme:

		What		**To whom**	**When/Where (Frequency in the course)**	**Max Marks**	**Evidence collected**	**Course outcomes**
Direct Assessment meth	CIE	IA		Students	Activities	10	Blue Book	2,3,4.5
					Record – Average marks of graded exercises to be computed	15	Graded exercises	2,3,4,5
	SEE	End Exam			End of the course	50	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course			Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey				End of the course		Questionnaires	1,2,3,4,5 Effectiveness of Delivery of instructions & Assessment Methods

Note: 1. The activity related exercises shall be evaluated as per the Rubrics developed by the concerned department related to the course.
  2. The course related graded exercises to be evaluated as per performance mentioned in SEE scheme of evaluation.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
  1. Blue books (Activity for 10 marks)
  2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Scheme of Valuation for End Examination
Note: Any one model in any one practice

Serial no	Description	Marks
1	Listing of tools & operations required for performing job	05
2	Marking of job	05
3	Operation performed	15
4	Dimensional accuracy of job	15
5	Finishing of job	10
	TOTAL	**50**

1. Turret and Capstan Lathes 01
2. Horizontal Milling Machine 01
3. Vertical Milling Machine 01
4. Surface Grinding Machine 01
5. Cylindrical Grinding Machine 01
6. Shaper 02
7. Planner 01
8. Radial Drilling Machine 01
9. Power tools-Drilling
10. Power tools-grinding
11. Power tools-polishing
12. Cordless screw driver

## GENERAL INSTRUCTION IN WORK SHOP

1. Every student should obtain a set of instruction sheets entitled manufacturing processes Laboratory.
2. For reasons of safety, every student must come to the laboratory in shoes. it is unsafe for the students to come to the laboratory wearing garments with parts that that hang about loosely. Students should preferably Use half-sleeve shirts. The Students should also ensure that floor around the machine is clear and dry (not oily) to avoid slipping.
3. An apron will be issued to each student. Students not wearing an apron will not be permitted to the work in the laboratory.
4. Instruments and tools will be issued from the tool room. Every student must produce his identity card for the purpose. Tools, etc. must be returned to the tool room on the same day.
5. The student should take the permission of the Lab Staff / Tutor before handling any machine.
6. The student should not lean on the machine when it is working.
7. Power to the machines will be put off 10 minutes before the end of laboratory session to allow the students to return the tools.
8. Students are required to clear off the chips from the machine and lubricate the guides etc. at the end of the session.
9. Laboratory reports should be submitted on blue Book.
10. Blue Book will not be returned to the students.

UNIT I: TURNING PRACTIC -24 Hrs
(NOTE: INDIVIDUAL MODEL)

1. To make the part shown in the sketch from a mild steel rod on a Lathe
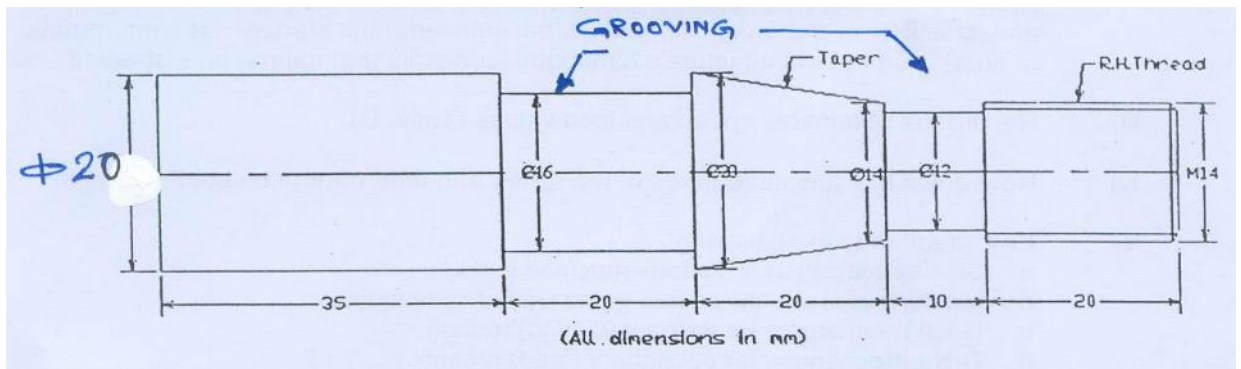
EQUIPMENT: List all tools and instruments used.

OUTLINE OF PROCEDURE

Hold the bar in a three jaw chuck and face the end with a right hand facing tool. Make central hole with a center drill. Repeat these' operations for the other end of the bar. Replace the chuck by a dog plate (Center plate) and hold the job in a carrier between centers. Turn the bar to the required diameter with rough cuts. Face the steps and finishes the diameters to the required sizes. Machine the roots and the groove with form tools. Machine the taper with the help of the cross-slide swiveling arrangement. Knurl the required surface. Cut the threads.

OBSERVATIONS

(a) Measure all dimensions (up to second decimal place) on the specimen turned by your group. Make a neat sketch and indicate all measured dimensions.

(b) Discuss briefly how tapered portion was turned.

(c) Show the calculation of the required gear ratio for thread cutting.

(d) Sketch the main drive unit of 'the- lathe and show how the speed steps are obtained.
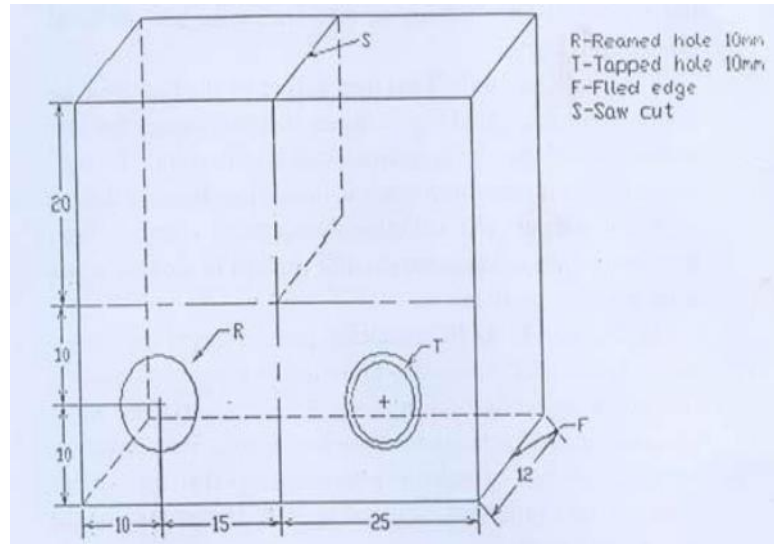
UNTII: DRILLING PRACTICE   -12Hrs
(NOTE: INDIVIDUAL MODEL)

UNTII: DRILLING PRACTICE	12Hrs

2. To drill, file, as shown in the sketch, out of the work piece provided and tap holes on the mild steel plate.)

R-Reamed hole 10mm
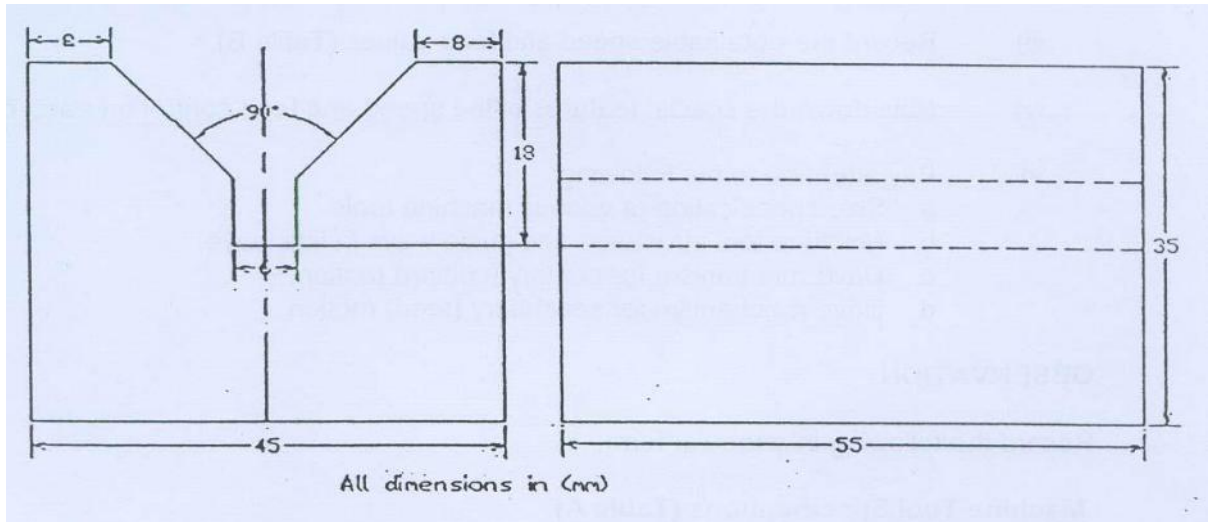T-Tapped hole 10mm
F-Filed edge
S-Saw cut

OBJECTIVE: To study the characteristic features of Drilling machine.

OUTLINE OF PROCEDURE

i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced. Note particularly the features, which control the geometrical form of the surface.

ji) Learn the names of the major units and the components of each machine. Record these details (Table A). (Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.

jii) Record the obtainable speed and feed values

iv) Note down the special features *of* the speed and feed control on each machine,

v) Pay attention to the following:
    a, Size specification *of* various machine tools,
    b, Machine tool structures and guide ways I slide ways.
    c. Drive mechanism for primary (cutting) motion,
    d. Drive mechanism for secondary (feed) motion.

UNIT III: SHAPING PRACTICE -12Hrs
(NOTE:ONE MODEL FOR GROUP OF 05 STUDENTS)

3. To machine a V-block as shown in the sketch out of the work piece provided.

All dimensions in (mm)

OBJECTIVE: To study the characteristic features of Shaper.

OUTLINE OF PROCEDURE
i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced. Note particularly the features, which control the geometrical form of the surface.
 ii) Learn the names of the major units and the components of each machine. (Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently started. Do not remove guards). Use the manufacture's handbook for details that cannot be inspected.
iii} Record the obtainable speed and feed values
iv) Note down the special features of the speed and feed control on each machine.
v) Pay attention to the following:
      a. Size specification of various machine tools.
      b. Machine tool structures and guide ways I slide ways.
      c. Drive mechanism for primary (cutting) motion.
      d. Drive mechanism for secondary *(feed)* motion.

OBJECTIVE: To Machine V-Block

EQUIPMENT
List all tools and instruments used.
OUTLINE OF PROCEDURE
Hold the work piece in a vice and machine the bottom surface shown in the sketch. Invert the casting in the vice and machine the top surface till the desired height is obtained. Machine the inclined faces using right and left hand tools. Finally machine the groove.
OBSERVATIONS
(a) Measure all dimensions (up to second decimal place) on he specimen machined by your group. Make a neat sketch and indicate all measured dimensions.
(b) Calculate the machining time *for* the bottom surface of the specimen.
(c) Explain -the quick return mechanism.

(d) Explain the use of clapper box on the machine.

UNIT IV:MILLING PRACTICE -24 Hrs

(NOTE:ONE MODEL FOR GROUP OF 05 STUDENTS)

4. To machine the hexagonal head and the slot shown in the sketch on the specimen,

EQUIPMENT: List all tools / cutters and instruments used.

OUTLINE OF PROCEDURE
Fit the helical cutter on the arbor and the specimen between the centers of the dividing head and the tail center. Carefully adjust the work piece so that the cutter just touches the top surface of the specimen. Calculate the necessary depth of cut and then mill the six *faces* of the hexagonal head in succession. Change the cutter and mill the rectangular slot. Cut at least 2 Spur gear teeth on round rod by using milling gear teeth cutter.
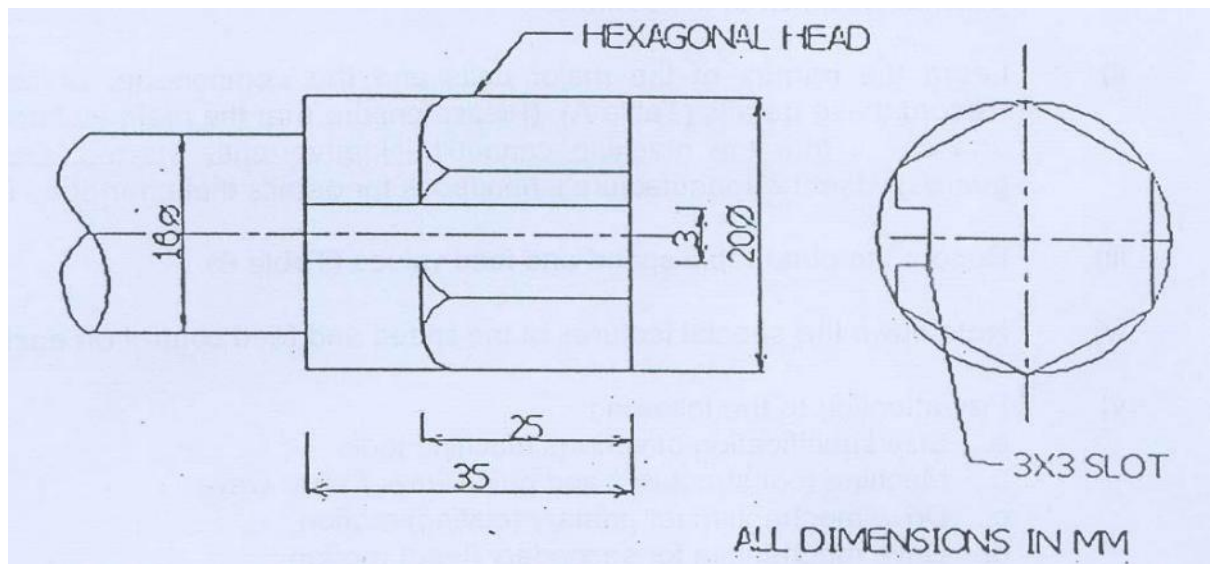

OBSERVATIONS
  (a) Measure all dimensions (up to second decimal place) on the specimen milled by your group. Make a neat sketch and indicate all measured dimensions.
  (b) Explain in brief how the required indexing was obtained with the dividing head.
  (c) Explain up-milling and down-milling operations. Which one did you use *for* slot milling and why?
  (d) Explain the advantages of using a helical milling cutter.
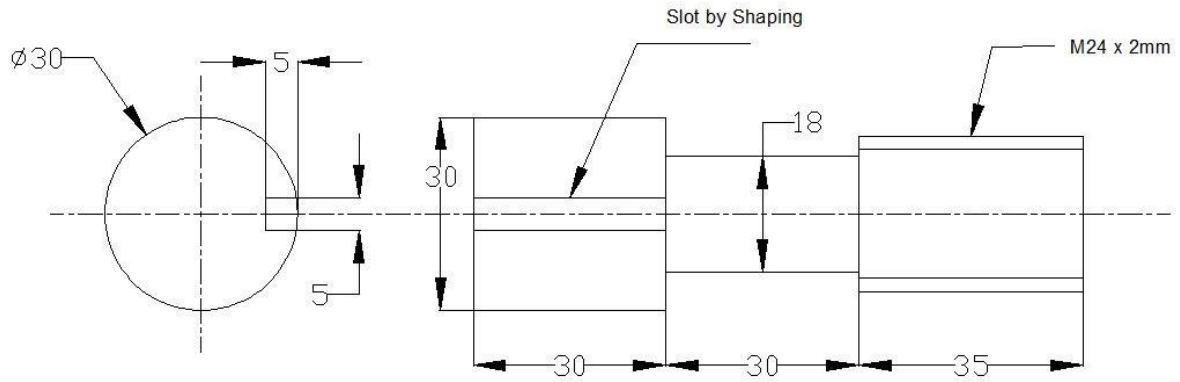
COURSE TITTLE: **MACHINE SHOP**

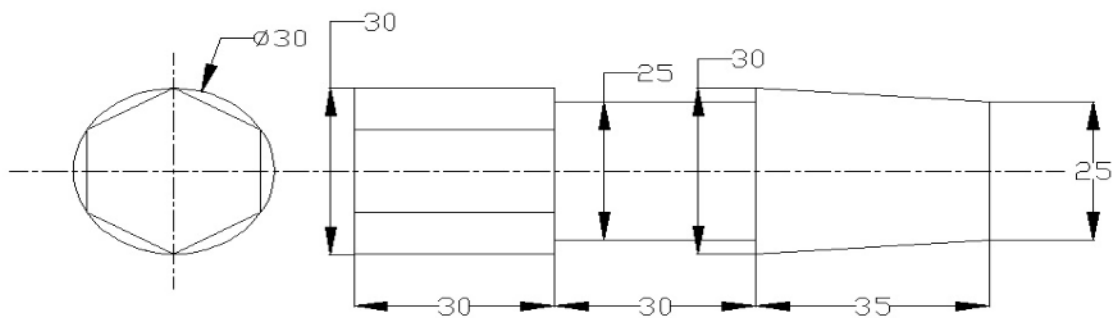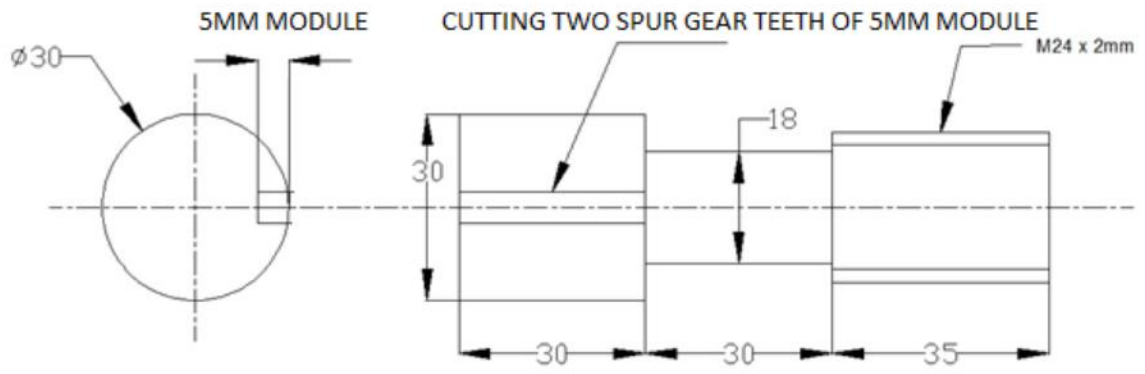TIME: 3 HOURS   MARKS:50

1.Prepare the model as per the given sketch

2.Prepare the model as per the given sketch

3.Prepare the model as per the given sketch

5MM MODULE   CUTTING TWO SPUR GEAR TEETH OF 5MM MODULE

Ø30

M24 x 2mm

30

18

30   30   35

	Course Title: **C PROGRAMMING LAB**		
Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code:**15ME47P**
Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Knowledge of computer operation.

Course Objectives:

1. Apply the specification of syntax rules for numerical constants and variables, data types,
2. Usage of Arithmetic operator, Conditional operator, logical operator and relational operators and other C constructs.
3. Write C programs using decision making, branching, looping constructs
4. Apply and Write C programs to implement one dimensional and two dimensional arrays
5. Writing programs using functions

Course Outcome:

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked Exercise**	**Linked PO**	**Teaching Hrs**
CO1	Acquire logical thinking, Implement the algorithms and analyze their complexity, Identify the correct and efficient ways of solving problems	U/A	1 to 10	1,2,3,5,10	**69**
CO2	Implement real time applications using the power of C language features.	U/A	11,12,13	1,2,3,4,5,10	**09**
			Total sessions		**78**

Legend: R; Remember, U: Understand A: Application

1. COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE SHOP	3	3	3	1	3	-	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Introduction to C programming- Need for a computer language, types of computer languages, features of C, Character set- Structure of C program., keywords, statements, standard library functions, pre-processor, main function, comments, variables, data types, operators, assignments, strings, format specifies, escape sequences, control structures-sequential, conditional, repetitive/looping, arrays-one & two dimensions, user defined functions

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
C PROGRAMMING		
1	Introduction to C programming (Lecture and demo).And Write C programme to convert the temperature in degree Celsius to degree Fahrenheit.	04+05
2	To find the sum and average of 3 real numbers.	01+02
3	To find the sum of even and odd numbers from 1 to N.	01+02
4	To find the sum of digits of a number.	01+02
5	To reverse the given integer and check whether it is a palindrome or not	02+04
6	To find the roots of a quadratic equation using switch statement.	03+06
7	To arrange N numbers in ascending order using Bubble sort technique	03+06
8	To perform addition of two matrices.	03+06
9	To perform a multiplication of two matrices after checking the compatibility for multiplication.	03+06
10	To find the largest of 3 numbers using functions (functions with arguments and return value)	03+06
11	To find the distance travelled by a vehicle, given it's initial velocity 'u', acceleration 'a' and time 't' [$S = ut + 1/2at^2$]	01+02
12	To find out Clearance volume of an Engine, given its bore diameter, Length of stroke and Compression ratio	01+02
13	To find the power transmitted by shaft by inputting the value speed and torque transmitted	01+02
	TOTAL	**78Hrs**

Note: For the above exercises, first the flowchart should be developed and then the programs should be written and executed.

 Concepts in C- Balaguruswamy

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 10 marks (Any one)
1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Ask the students to take the simple problems in Hydraulics , develop a C Programme
2	Ask the students to take the simple problems in Strength of Materials , develop a C Programme
3	Ask the students to take the simple problems in Thermal engineering, develop a C Programme

Course Delivery:
The course will be delivered through lectures and presentations

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct meth **Assessment**	CIE	IA	Students	Student Activities	10	Activities sheet	1,2
				Record – Average marks of graded exercises to be computed	15	Graded exercises	1,2
				End of the course	50	Answer scripts at BTE	1,2
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination
Note:
1. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

• MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

RUBRICS FOR ACTIVITY(5 Marks)

Dimension	Unsatisfactory 2	Developing 4	Satisfactory 6	Good 8	Exemplary 10	Student Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	6
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	8
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	8
Average / Total marks=(4+6+8+8)/4=26/4=6.5=7						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
1. Student suggested activities report for 10 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Scheme of Valuation for End Examination

Serial no	Description	Marks
1	**Writing Programme**	20
2	**Execution**	20
4	**Viva**	10

	TOTAL	50

1. Latest Configuration Computers -20 no
2. C software
3. **LCD Projector**

MODEL QUESTION PAPER

IV Semester Diploma in Mechanical Engineering
C-PROGRAMMING LAB

Time: 3 **Hours**   [Max Marks**: 50]**

1. Write C programme for Finding the power transmitted by shaft by inputting the value speed and torque.

Writing Programme	20
Execution	20
Viva	10
TOTAL	50

MODEL QUESTION BANK

IV Semester Diploma in Mechanical Engineering
C-PROGRAMMING LAB

1	Write C programme to convert the temperature in degree Celsius to degree Fahrenheit.
2	To find the sum and average of 3 real numbers.
3	To find the sum of even and odd numbers from 1 to N.
4	To find the sum of digits of a number.
5	To reverse the given integer and check whether it is a palindrome or not
6	To find the roots of a quadratic equation using switch statement.
7	To arrange N numbers in ascending order using Bubble sort technique
8	To perform addition of two matrices.
9	To perform a multiplication of two matrices after checking the compatibility for multiplication.
10	To find the largest of 3 numbers using functions (functions with arguments and return value)
11	To find the distance travelled by a vehicle, given it's initial velocity 'u', acceleration 'a' and time 't' [$S = ut + 1/2at^2$]
12	To find out Clearance volume of an Engine, given its bore diameter, Length of stroke and Compression ratio
13	To find the power transmitted by shaft by inputting the value speed and torque transmitted

| | | | | Teaching scheme | | | | | Examination scheme | | | | |

KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.

TEACHING AND EXAMINATION SCHEME FOR KANNADA COURSE IN DIPLOMA PROGRAME

SEMESTER: III	COMMON TO ALL DIPLOMA PROGRAMMES									C-15 Curriculum				
SL.N0	COURSE NAME	Teaching Department	COURSE /QP CODE	Teaching scheme / Contact hours					Examination scheme					
				TH	TU	PR	TOTAL	Credit	Exam paper duration in Hrs	End exam		Maximum CIE Marks (IA+SA)	Minimum Marks for passing. (IA + SA)
										Max marks	Min marks		
	THEORY												
1	KANNADA KALI-1	KA	15KA3NT	2	-	-	2	2	-	-	-	50	20
2	TANTRIKA KANNADA -1	KA	15KA3KT	2	-	-	2	2	-	-	-	50	20

CIE- Continuous Internal Examination: SEE-Semester End Examination: IA-Internal Assessment Tests: SA- Student Activity.

Note: 1. Candidates studied Kannada as one subject in 10th standard shall take Tantrika Kannada 1 &2. Others may take "Kannada Kali-1&2".

2. In 3rd Semester- Assessment is only by CIE and no SEE. Average marks of three I A tests shall be rounded off to the next higher digit. Rubrics to be devised appropriately to assess student activity.

KARNATAKA STATE BOARD OF TECHNICAL EXAMINATION, BENGALURU.

TEACHING AND EXAMINATION SCHEME FOR KANNADA COURSE IN DIPLOMA PROGRAME

SEMESTER: IV	COMMON TO ALL DIPLOMA PROGRAMMES									C-15 Curriculum				
SL.N0	COURSE NAME	Teaching Department	COURSE /QP CODE	Teaching scheme / Contact hours					Examination scheme					
				TH	TU	PR	TOTAL	Credit	Exam paper duration in Hrs	Sem End Exam		Maximum CIE Marks (IA+SA)	Minimum Marks for passing. (IA + SA)
										Max Exam Marks	Min Passing Marks		
	THEORY												
1	KANNADA KALI-2	KA	15KA4NT	2	-	-	2	2	2	50	20	-	-
2	TANTRIKA KANNADA -2	KA	15KA4KT	2	-	-	2	2	2	50	20	-	-

CIE- Continuous Internal Examination: SEE-Semester End Examination: IA-Internal Assessment Tests: SA- Student Activity.

Note: In 4th Semester- Assessment is only by SEE and no CIE. To award diploma certificate, passing in Kannada course is mandatory. However Kannada course is not included in the eligibility criteria for promotion to the higher semester.

4ನೇ ಸೆಮಿಸ್ಟರ್-ಕನ್ನಡ ಕಲಿ-2 (ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಪರಿಚಯ)

4th Semester	Course: Kannada Kali-2	Course Code:15KA4NT (2016-17)
	No. of Credits:02	No. of teaching hours/week:02 No. of teaching hours/Semester:26
	Mode of Assessment and Evaluation: Semester End Examination (SEE)only. No CIE.	Maximum Marks: 50 (SEE only) Minimum Passing marks:20

ಉದ್ದೇಶ:

1. ಕೇಳುವುದು, ಗ್ರಹಿಸುವುದು, ನಿರರ್ಗಳವಾಗಿ ಮತ್ತು ಸ್ಪಷ್ಟವಾಗಿ ಓದುವ ಮತ್ತು ಮಾತನಾಡುವ (ಅಭಿವ್ಯಕ್ತಿಸುವ) ಸಾಮರ್ಥ್ಯವನ್ನು ಬೆಳೆಸುವುದು.
2. ಜ್ಞಾನಾರ್ಜನೆ, ಸಾಹಿತ್ಯಾಭಿರುಚಿ, ಚಿಂತನೆ ಮತ್ತು ಆನಂದಕ್ಕಾಗಿ ಸ್ವತಂತ್ರವಾಗಿ ಓದಲು, ಬರೆಯಲು ಮತ್ತು ಮಾತನಾಡಲು ಸಮರ್ಥರಾಗುವಂತೆ ಮಾಡುವುದು.
3. ಪದ ಸಂಪತ್ತನ್ನು ಹೆಚ್ಚಿಸಿಕೊಂಡು ಸ್ಪಷ್ಟ ಉಚ್ಛಾರಣೆಯೊಡನೆ ಲಿಖಿತ ಮತ್ತು ಮೌಖಿಕ ಚಟುವಟಿಕೆಗಳನ್ನು ಮಾಡಿಸಿ, ಸ್ವತಂತ್ರವಾಗಿ ಭಾಷೆಯ ಬಳಕೆ ಮಾಡುವುದು.
4. ನಾಡು-ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಸಾಹಿತ್ಯಗಳ ಪರಿಚಯ ಮತ್ತು ಆತ್ಮೀಯ ಭಾವಾಭಿಮಾನವನ್ನು ಬೆಳೆಸುವುದು.
5. ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆಗಳಿಂದ ಭಾಷಾ ಕೌಶಲ್ಯದ ಸರಳ ಪ್ರಯೋಗ ಮಾಡಿಸುವುದು./ಕಲಿಸುವುದು.
(ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆ ಎಂದರೆ, ವರ್ಣಮಾಲೆ ಪರಿಚಯ, ವ್ಯಾಕರಣದ ಸರಳ ಪರಿಚಯ, ಗುಣಿತಾಕ್ಷರ, ಸಂಯುಕ್ತಾಕ್ಷರಗಳು, ನಾಮಪದ, ಲಿಂಗ, ವಚನ, ಪ್ರತ್ಯಯಗಳು, ವಾಕ್ಯರಚನೆ (ಕರ್ತೃ, ಕರ್ಮ, ಕ್ರಿಯಾಪದ) ಇತ್ಯಾದಿ).

Course outcome:
1. Developing listening and speaking skills.
2. Easy Interaction with peers.
3. Students can use the language at ease in daily life situations

ಪಠ್ಯಕ್ರಮ ಮತ್ತು ಸರಳ ಭಾಷಾ ಕೌಶಲ್ಯ
(ಕನ್ನಡ ಕಲಿ-ಪಠ್ಯಪುಸ್ತಕ -ಶ್ರೀ ಲಿಂಗದೇವರು ಹಳೇಮನೆ – ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ ಪ್ರಕಾಶನ)

ಭಾಗ-2

ಪಾಠಗಳ ಕ್ರಮಾಂಕ Lesson No	ಪಠ್ಯವಸ್ತುವಿನ ವಿವರ – Curriculum Content	ಸೆಮಿಸ್ಟರ್ ಬೋಧನ ಆವಧಿ Total no.of Classes /Sem
Part-I		
11	Plan to go for a movie. Comparative, non-past tense, instrumental and ablative case	02
12	Conversation between Doctor & Patient. Potential forms, accusative case.	02
13	Enquiring about friend's family	02

	Past tense -d, and -t- and -id-, negation.	
14	Conversation between friends – Past tense –k – T – D and –id-v negation verbal noun	02
15	Routine activities of a Student.	01
16	About children's education. Continuous, Perfect tenses and negations.	02
17	Halebidu - Belur Relative participle, negation and Participle nouns.	02
18	Discussing about Examination and future plan-conditional and negative conditions.	03
19	Karnataka (Lesson for reading)(reading skill)	03
20	bEku bEDagaLu (Lesson for reading (Reading skill)	03
Part-II	Kannada Scripts	03
	ECA-word/sentence formation/letter/small essay writing	01
	ಒಟ್ಟು ಗಂಟೆಗಳು	26

ಸೂಚನೆಗಳು:

- ಮೇಲಿನ ಪಾಠಗಳ ಪುನರಾವರ್ತಿತ ಭಾಗಗಳಿಗೆ ಬದಲಾಗಿ "ಕ್ರಿಯಾತ್ಮಕ ಚಟುವಟಿಕೆ"ಯಿಂದ ಗಳಿಸುವ ಅಕ್ಷರ ಜ್ಞಾನ ದಿಂದ ಪದ ಸಂಪತ್ತು ಹೆಚ್ಚಿಸಿ, ಪದಗಳಿಂದ ಸ್ವಂತ ವಾಕ್ಯಗಳ ರಚನೆ ಮಾಡಿಸುವುದು. (ಅಮ್ಮ, ಮೊಬೈಲ್, ಕನ್ನಡ ಭಾಷೆ, ಕವಿಗಳು, ನಾಟಕ, ಜನಪದ ಕಲೆ, ನಾಡಿನ ಪ್ರಸಿದ್ಧ ವ್ಯಕ್ತಿಗಳು, ಸಹೋದರ, ಸ್ನೇಹಿತ, ತರಕಾರಿ, ದೋಸೆ, ತಿಂಡಿ, ನಿದ್ದೆ, ಬಿಸಿ, ಚಳಿ, ಆಕಾಶ, ಓದು, ಇತ್ಯಾದಿ ನಿತ್ಯ ಬಳಕೆಯ ಸರಳ ಪದಗಳಿಂದ ವಾಕ್ಯರಚನೆ ಮತ್ತು 25– 50 ಪದಗಳ ಕಿರು ಪ್ರಬಂಧ ರೂಪದ ಲೇಖನ ರಚನೆ).

- ಸಂಸ್ಥೆಯ ಪ್ರಾಚಾರ್ಯರಿಗೆ ವಿದ್ಯಾರ್ಥಿಯ ಮನವಿ ಪತ್ರ, ಕುಂದುಕೊರತೆಗಳ ಬಗ್ಗೆ ಸಂಬಂಧಿಸಿದವರಿಗೆ ಪತ್ರ, ಸ್ನೇಹಿತರಿಗೆ ಪತ್ರಗಳು, ಸರಳವಾಗಿ ಯಾವುದೇ ಸಾಮಾನ್ಯ ವಿಷಯಗಳ ಬಗ್ಗೆ ಪತ್ರಲೇಖನ. (6–10 ವಾಕ್ಯಗಳು).

ಆಕರ ಗ್ರಂಥಗಳು:

1. ಕನ್ನಡ ಕಲಿ–ಶ್ರೀ ಲಿಂಗದೇವರು ಹಳೇಮನೆ – ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರಾಥಮಿಕ ಶಾಲೆಯ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕಗಳು
3. ಸರಳ ಕನ್ನಡ ವ್ಯಾಕರಣ ಪುಸ್ತಕಗಳು– ಎಂ.ವಿ ನಾಗರಾಜರಾವ್/ಇತರೆ ಲೇಖಕರು.
4. ಪ್ರಯೋಗ ಪ್ರಗತಿ–ಪ್ರಥಮ ಪಿಯುಸಿ ಪೂರಕ ಪಠ್ಯ.
5. ಸರಳ ಪತ್ರವ್ಯವಹಾರದ ಪುಸ್ತಕಗಳು

ಡಿಪ್ಲೋಮಾ 4ನೇ ಸೆಮಿಸ್ಟರ್–*ಕನ್ನಡ ಕಲಿ–2 (ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಪರಿಚಯ)*

ಸೆಮಿಸ್ಟರ್ ಅಂತಿಮ ಲಿಖಿತ ಪರೀಕ್ಷೆ

ಸಮಯ: 2 ಗಂಟೆಗಳು   ಗರಿಷ್ಠ ಅಂಕಗಳು:50
––

1. Fill in the blanks using the appropriate words.

2. Rewrite as directed.

3. Combine the following sentences.

4. Translate into Kannada.

5. Answer the following questions.

6. Fill in the blanks using the correct past tense forms of the verbs giving in the bracket.

7. Transform into negative.

8. Substitute and complete the sentence

9. Vocabulary (meanings of words) using formation of sentences (any five).

10. Questions from lessons 17 to 19. (Out of 6 questions, answer any 3 questions).

11. Scripts- consonants form- +vowel (10 types)

12. Conversation & other questions. (KK-Exercises)

ಮಾದರಿ ಪ್ರಶ್ನೆಪತ್ರಿಕೆ:

ಡಿಪ್ಲೋಮಾ 4ನೇ ಸೆಮಿಸ್ಟರ್–*ಕನ್ನಡ ಕಲಿ–2 (ಕನ್ನಡೇತರರಿಗೆ ಕನ್ನಡ ಪರಿಚಯ)*

ಸೆಮಿಸ್ಟರ್ ಅಂತಿಮ ಲಿಖಿತ ಪರೀಕ್ಷೆ

ಸಮಯ: 2 ಗಂಟೆಗಳು   ಗರಿಷ್ಟ ಅಂಕಗಳು:50

I.   (a) Fill in the blank using the correct past tense forms of the verbs given in the
        bracket.   3+2 =05
        1.ಅವರು ನಿನ್ನೆ ಊರಿನಿಂದ ....   (ಬಾ)
        2. ಅವಳು ಒಂದು ಹೆಣ್ಣು ಮಗು ....   (ಹೆರು)
        3.ನಾನು ನಿನಗಾಗಿ ತುಂಬಾ ಹೊತ್ತು...............   (ಕಾಯು)

        (b) Fill in the blank using the correct verbal participle forms of the verbs given in
        the bracket.
        1.ಆ ಹುಡುಗಿ ಮನೆ .... ಹೋದಳು. (ಬಿಡು)
        2. ಅವನು ಇವತ್ತ ಊರಿನಿಂದ.............ನಾಳೆ ಬರುತ್ತಾನೆ. (ಹೊರಡು)

II. Give the negative forms of the following sentence.   (Any Five)   1X5=05

    ಅ) ನೀವು ಪುಸ್ತಕ ಕೊಡಿ.

    ಆ) ನೀವು ಸಿಗರೇಟ್ ಸೇದಬಹುದು.

    ಇ) ಅವರು ನನಗೆ ಚೆನ್ನಾಗಿ ಗೊತ್ತು.

    ಈ) ಅವರು ಕನ್ನಡ ಚೆನ್ನಾಗಿ ಕಲಿತರು.

    ಉ) ಅವಳು ತಲೆ ಬಾಚಿಕೊಂಡು ಬಂದಳು.

    ಊ) ಅವನಿಗೆ ಫೋನ್ ಬಂದಿದೆ.

    ಎ) ರವಿ ಮನೆಯಲ್ಲಿ ಮಲಗಿರ್ತಾನೆ.

III. Translate into KANNADA. (Any Five)   2X5=10

    1) Who will come with you?
    2) Today Ms. Kamala will go to her native place.
    3) You must drink butter milk daily.
    4) Please, don't talk to me.

5) How much advance money did you pay for the hostel?
6) How many of you are learning Kannada seriously?
7) If I get good marks in diploma, I will get admission for BE program.
8) At what time today you will be available in the hostel?.

   IV. Vocabulary.

 (a) Write English equivalents of the Kannada words. (Any five)   1X5=05

     1. ಆಗಸ 2. ಶೈಲಿ 3. ಅನುಮಾನ 4.ಪರೀಕ್ಷೆ   5.ಜಾತಿ   6.ನೈಸರ್ಗಿಕ 7.ಮತ 8. ವಾಣಿಜ್ಯ

   (b) Write Kannada equivalents of the English words.   (Any five)   1X5=05

     1. Wealth 2. Religion 3. Memory 4.fear 5.Environment 6. Primary 7. Mistakes 8. Tall

VI. Conversation:

ಈ ಕೆಳಗಿನ ಅಪೂರ್ಣ ಸಂಭಾಷಣೆಯನ್ನು ಆವರಣದಲ್ಲಿ (bracket) ನೀಡಿರುವ ಪದಗಳನ್ನು ಅರ್ಥಮಾಡಿಕೊಂಡು ಪೂರ್ತಿ ಮಾಡಿ.   –05

   ರಾಜು: ನಿನಗೆ ನಿನ್ನೆ ಮೋಹನ್ ಸಿಕ್ಕನಾ?
   ರಾಮು: .... negative)   ನಿನಗೆ ಸಿಕ್ಕನಾ?
   ರಾಜು ....   (Positive) ಹೌದು, ನಿಮ್ಮನ್ನು ನೋಡುವುದಕ್ಕೆ ಹೋಗುತ್ತೇನಿ ಅಂತ ಹೇಳಿದ.
   ರಾಮು: ....   (Enquiring about meeting him)
   ರಾಜು: ಅವನು ಕೆಲಸ ಬಿಟ್ಟನಂತೆ.
   ರಾಮು: .... (Questioning)
   ರಾಜು: ....(Answer).

VII.Transform the following sentences as per direction. (Any Five)   1X5=05

   1. ಮಕ್ಕಳು ರಸ್ತೆಯಲ್ಲಿ ಆಟ ಅಡ್ತಾ   (into present continuous)   ಇದ್ದವು.
   2. ಹುಡುಗರು ತರಗತಿಯಲ್ಲಿ ಸುಮ್ಮನೆ (into present continuous) ನಗ್ತಾ ಇದ್ದರು.
   3. ಆ ಹೆಂಗಸರು ಜಗಳ ಆಡ್ತಾ ಇದ್ದಾರೆ. (into past continuous)
   4. ತರಕಾರಿ ಕಡಿಮೆ ಬೆಲೆಗೆ ಸಿಗ್ತಾ ಇದೆ. (into past continuous)
   5. ಅವನು ದಿನಾ ಇಲ್ಲಿಗೆ ಬರ್ತಾನೆ.   (into habitual)
   6. ಇಲ್ಲಿ ಬಸ್ಸುಗಳು ತುಂಬಾ ಓಡಾಡ್ತ (into habitual) ಇವೆ.
   7. ಆಂಧ್ರಪ್ರದೇಶದಿಂದ ಬಂದಿದ್ದ ವಿದ್ಯಾರ್ಥಿಗಳು ಎಲ್ಲಿದ್ದಾರೆ?(into present perfect)

VIII.Write the Kannada alphabet in the traditional order.   05

      OR
ಹಳೇಬೀಡು ಬೇಲೂರಿನಿಂದ ಎಷ್ಟು ದೂರದಲ್ಲಿದೆ ಮತ್ತು ಯಾವ ಜಿಲ್ಲೆಯಲ್ಲಿದೆ? ಇಲ್ಲಿನ ದೇವಸ್ಥಾನಗಳ ಹೆಸರುಗಳು ಏನು ಮತ್ತು ಅವುಗಳನ್ನು ಕಟ್ಟಿಸಿದವರು ಯಾರು?
IX. Combine the following: (Any One)   1X1=01

(A) 1) ಮನೆ + ಇಂದ =
    2) ಮ್ + ಔ =

(B) Combine the following sentence using verbal participle form. (Any One)   1X1=01

    ಅ) ಹುಡುಗರು ದುಡ್ಡು ಕೊಟ್ಟರು.
       ಹುಡುಗರು ಸರ್ಕಸ್ ನೋಡಿದರು.
    ಆ) ನಾನು ಕೆಲಸ ಮಾಡ್ತಾ ಇದ್ದೆ.
       ನಾನು ಎಂ.ಎ. ಓದಿದೆ.

(B) Frame meaningful small sentences with using words given given below:(Any Three) -1X3=03.
    ಅ) ಮರ   ಆ) ಫಲ   ಇ) ಊರು   ಈ) ಪೇಪರ್   ಉ) ಇವರು   ಊ) ಮನೆ ಎ) ಶಾಲೆ

ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ ರಚನಾ ಸಮಿತಿ

- **ಸಂಪಾದಕೀಯ ಸಮಿತಿ:**

1. ಶ್ರೀ ಟಿ ಎಲ್ ರವೀಂದ್ರ, ಉಪನ್ಯಾಸಕರು, ಸರ್ಕಾರಿ ಜಿ.ಆರ್.ಐ.ಸಿ.ಪಿ ಬೆಂಗಳೂರು.
2. ಶ್ರೀ ಟಿ. ತಿಮ್ಮಪ್ಪ, ಉಪನ್ಯಾಸಕರು(ಆಯ್ಕೆ ಶ್ರೇಣಿ), ಯಾಂತ್ರಿಕ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಪಾಲಿಟೆಕ್ನಿಕ್, ತುಮಕೂರು.

- **ಸಲಹಾ ಸಮಿತಿಯ ಬಾಹ್ಯ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಗಳು.**

1. ಪ್ರೊ. (ಡಾ.) ಡಿ. ಪಾಂಡುರಂಗ ಬಾಬು, ಕುಲಸಚಿವರು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರೊ. (ಡಾ.) ಅಶೋಕ್ ಕುಮಾರ್ ರಂಜರೆ, ಪ್ರಾಧ್ಯಾಪಕರು, ಪ್ರಸಾರಾಂಗ ವಿಭಾಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
3. ಪ್ರೊ. (ಡಾ.) ಕೆ ವೈ ನಾರಾಯಣ ಸ್ವಾಮಿ, ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು, ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಕಲಾ ಕಾಲೇಜು, ಬೆಂಗಳೂರು.
4. ಪ್ರೊ. (ಡಾ.) ಜೆ ಬಾಲಕೃಷ್ಣ, ಪ್ರಾಧ್ಯಾಪಕರು ಹಾಗು ಮುಖ್ಯಸ್ಥರು, ಕನ್ನಡ ಭಾಷಾ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ, (ಜಿಕೆವಿಕೆ) ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು.

4ನೇ ಸೆಮಿಸ್ಟರ್ – ತಾಂತ್ರಿಕ ಕನ್ನಡ –2 (ಸಾಹಿತ್ಯ ಮತ್ತು ಭಾಷಾ ಕೌಶಲ್ಯ ಪ್ರಯೋಗ)
ಪಠ್ಯಕ್ರಮ

4th Semester	Course: ತಾಂತ್ರಿಕ ಕನ್ನಡ –2	Course Code:15KA4KT (2016-17)
	No. of Credits:02	No. of teaching hours/week:02 No. of teaching hours/Semester:26
	Mode of Assessment and Evaluation: Semester End Examination (SEE)only. No CIE.	Maximum Marks: 50 (SEE only) Minimum Passing marks:20

ಪಠ್ಯ ಪ್ರಕಾರ	ಪಾಠ	ಪಠ್ಯದ ಹೆಸರು/ಲೇಖಕರು/ಪ್ರಕಟಣೆ	ಸೆಮಿಸ್ಟರ್ ಬೋಧನಾವಧಿ ಗಂಟೆಗಳು
ಕಾವ್ಯ ಮಂಜರಿ–(ಬದುಕು ಮತ್ತು ಮಾನವತೆ)	1	(ಕಾವ್ಯ ಗುಚ್ಛಗಳು) (1) ನನ್ನ ಹಣತೆ–ಡಾ:ಜಿ.ಎಸ್.ಎಸ್. (2) ಮಂಕು ತಿಮ್ಮನ ಕಗ್ಗ–ಡಿ.ವಿ.ಜಿ	02
ಸಂಸ್ಕೃತಿ	2	ಅಲೆಕ್ಸಾಂಡರ್ನ ಗುರುದಕ್ಷಿಣೆ–ಮಾಸ್ತಿ ವೆಂಕಟೇಶ ಅಯ್ಯಂಗಾರ್	02
ಪರಿಸರ/ಸಾಹಸ	3	ವೈನಾಡಿನ ನರಭಕ್ಷಕರು – ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ	02
ಕ್ರೀಡೆ/ಕಲೆ	4	ಜಿ.ಆರ್.ವಿಶ್ವನಾಥ್–ಡಾ: ಕ.ಪುಟ್ಟಸ್ವಾಮಿ	02
ತಂತ್ರಜ್ಞಾನ	5	ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ–ಒಂದು ಸ್ಥೂಲ ನೋಟ–ಜಿ.ಎನ್.ನರಸಿಂಹಮೂರ್ತಿ	02
ಯಶೋಗಾಥೆ/ವ್ಯಕ್ತಿಚಿತ್ರಣ	6	ಡಾ:ವಿಶ್ವೇಶ್ವರಯ್ಯ–ವ್ಯಕ್ತಿ ಮತ್ತು ಇತಿಹ್ಯ – ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್	02
ಭಾಷಾ ಕೌಶಲ್ಯ–ಚಟುವಟಿಕೆಗಳು	7	ಲಿಖಿತ ಅಭಿವ್ಯಕ್ತಿ: ಪತ್ರಗಳ ರಚನೆ–ವ್ಯಾಪ್ತಿ: ಪತ್ರದ ಭಾಷೆ, ಶೈಲಿ, ನಮೂನೆಗಳು (1) ವೈಯಕ್ತಿಕ ಪತ್ರ (ಪ್ರವಾಸ/ಕೋರಿಕೆ.(ಮನವಿ/ಆತ್ಮೀಯರಿಗೆ ಬರೆಯುವ ಪತ್ರಗಳು)..) (2) ಪತ್ರ ವ್ಯವಹಾರ (ವಾಣಿಜ್ಯ ಸಂಸ್ಥೆಗಳಿಗೆ ಬರೆಯುವ/ಪ್ರತ್ಯುತ್ತರ ಪಡೆಯುವ, ಬ್ಯಾಂಕ್ಗಳಿಗೆ/ಸರ್ಕಾರಿ ಕಚೇರಿಗಳಿಗೆ ಬರೆಯುವ ಪತ್ರಗಳು....)–ಮಾದರಿಗಳು (3) ಅಭ್ಯರ್ಥನ ಪತ್ರ (ಹುದ್ದೆಗೆ ಅರ್ಜಿ) –1–2 ನಮೂನೆಗಳು–4–5 ಪ್ರಶ್ನೆಗಳು (4) ಓದುಗರ ವಿಭಾಗಕ್ಕೆ ಪತ್ರಿಕಾ ಸಂಪಾದಕರಿಗೆ ಬರೆಯುವ ಪತ್ರಗಳು 1 ನಮೂನೆ–3–4 ವಿಷಯಗಳ ಮೇಲೆ ಪತ್ರ ಬರೆಸುವುದು.	06
	8	ಸಂಕ್ಷಿಪ್ತ ಲೇಖನ (ಸಾರಾಂಶ ಲೇಖನ)	02
	9	ಮೌಖಿಕ ಅಭಿವ್ಯಕ್ತಿ> ಚರ್ಚಾ ಸ್ಪರ್ಧೆ/ಕೂಟ–ಭಾಷಣ–ಆಶುಭಾಷಣ –ಕಾರ್ಯಕ್ರಮ ನಿರೂಪಣೆ ಮಾಡುವುದು.	06
		ಒಟ್ಟು ಅವಧಿ	26 ಗಂಟೆಗಳು

ಡಿಪ್ಲೋಮಾ 4ನೇ ಸೆಮಿಸ್ಟರ್ (ಕನ್ನಡಬಲ್ಲ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ)
ತಾಂತ್ರಿಕ ಕನ್ನಡ–2
ಪರಿವಿಡಿ

ಭಾಗ–1

ಕಾವ್ಯ ಗುಚ್ಛ
1. ನನ್ನ ಹಣತೆ–ಡಾ:ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
2. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ–ಡಿವಿಜಿ

ಗದ್ಯ ಸಾಹಿತ್ಯ
3. ಅಲೆಕ್ಸಾಂಡರನ ಗುರುದಕ್ಷಿಣೆ (ಸಂಸ್ಕೃತಿ–ಕತೆ)–ಶ್ರೀನಿವಾಸ (ಮಾಸ್ತಿ)
4. ವೈನಾಡಿನ ನರಭಕ್ಷಕರು (ಪರಿಸರ–ಸಾಹಸ)–ಕೆ.ಪಿ.ಪೂ.ತೇಜಸ್ವಿ
5. ಲಿಟ್ಲಲ್ ಮಾಸ್ಟರ್ (ಕ್ರೀಡೆ/ಕಲೆ)–ಡಾ.ಕೆ.ಪುಟ್ಟಸ್ವಾಮಿ
6. ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ–ಜಿ.ಎನ್.ನರಸಿಂಹಮೂರ್ತಿ
7. ಡಾ:ವಿಶ್ವೇಶ್ವರಯ್ಯ–ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ–ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್

ಭಾಗ–2   –ಭಾಷಾ ಕೌಶಲ್ಯ ಚಟುವಟಿಕೆಗಳು

(1)ಬರಹ ರೂಪದ ಸಂವಹನ ಕನ್ನಡ–ಅಭಿವ್ಯಕ್ತಿಯ ಸ್ವರೂಪ
ಔಪಚಾರಿಕ ಮತ್ತು ಅನೌಪಚಾರಿಕ ಪತ್ರಗಳು

(ಅ) ಪತ್ರವ್ಯವಹಾರ–ವ್ಯಾಖ್ಯೆ–ವಿವರಣೆ

(ಆ) ಪತ್ರಗಳ ಮಾದರಿಗಳು

1. ವಾಣಿಜ್ಯ ಪತ್ರಗಳು–ವ್ಯಾಖ್ಯೆ, ಕೆಲವು ವಿಧಗಗಳು

2. ಖಾಸಗಿ/ವೈಯಕ್ತಿಕ ಪತ್ರಗಳು

3. ಪತ್ರಿಕೆಗಳಿಗೆ ಬರೆಯುವ (ಓದುಗರ)ಪತ್ರಗಳು

4. ಅಭ್ಯರ್ಥನ ಪತ್ರಗಳು

(2) ಸಾರಾಂಶ ಲೇಖನ: ವ್ಯಾಖ್ಯೆ, ಉದ್ದೇಶ, ವಿಧಾನಗಳು.

3 . ಮೌಖಿಕ ಅಭಿವ್ಯಕ್ತಿ ಚಟುವಟಿಕೆಗಳು(ತರಗತಿ ಚಟುವಟಿಕೆಗಳು)

1. ವಿಷಯಾತ್ಮಕ ಭಾಷಣಗಳು

2. ಆಶುಭಾಷಣ (ರಚನಾತ್ಮಕ ವಿಷಯಗಳು)

3. ಚರ್ಚೆ (ವಿಚಾರ ವಿನಿಮಯ/ಪರ–ವಿರುದ್ಧ ವಾದ ಮಂಡನೆ)

4. ನಿರೂಪಣೆ

Course outcome:
 1. Developing listening and speaking skills.
 2. Easy Interaction with peers.
 3. Students can use the language at ease in daily life situations

ಡಿಪ್ಲೋಮಾ ನಾಲ್ಕನೇ ಸೆಮಿಸ್ಟರ್ (ಕನ್ನಡ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ)

ತಾಂತ್ರಿಕ ಕನ್ನಡ–2

ಸಮಯ: **2.00** ಗಂಟೆ   ಅಂಕಗಳು: 50

I. ಕೆಳಗಿನ ಯಾವುದೇ **ಐದು** ಪ್ರಶ್ನೆಗಳಿಗೆ 1–2 **ಪೂರ್ಣ** ವಾಕ್ಯಗಳಲ್ಲಿ ಉತ್ತರಿಸಿ.   1X5=05

 (1) ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನದ ಮಾಹಿತಿಯನ್ನು ನಷ್ಟಗೊಳಿಸುವ ಅನಿಷ್ಟ ಯಾವುದು?

 (2) ದಿವಾನ್ ಪದವಿ ಬಂದಾಗ ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯನವರು ತಮ್ಮ ತಾಯಿಗೆ ಹೇಳಿದ ಮಾತೇನು?

 (3) ಅರಿಸ್ಟಾಟಲ್ ಯಾರು ಮತ್ತು ಅವರು ಅಲೆಕ್ಸಾಂಡರನಿಗೆ ಏನಾಗಬೇಕು?

 (4) ಸುತ್ತೋಲೆ ಅಥವ ಪರಿಪತ್ರ ಎಂದರೇನು?

 (5) ಫಿನಿಕ್ಸ್ ಎಂದರೇನು?

 (6) 'ಖಡ್ಗ' ಎಂದರೇನು?

 (7) ನಿರೂಪಕರೆಂದರೆ ಯಾರು?

II. ಕೆಳಗಿನ ಯಾವುದೇ **ಮೂರು** ಪ್ರಶ್ನೆಗಳಿಗೆ ಸಂಕ್ಷಿಪ್ತವಾಗಿ ಉತ್ತರಿಸಿ.   5X3=15

 (1) ಕವಿ "ಹಣತೆ ಹಚ್ಚುತ್ತೇನೆ ನಾನು' ಎಂದು ಏಕೆ ಹೇಳುತ್ತಾರೆ?

 (2) ಕ್ಲಿಯಾಂತಸನ ಸಾವು

 (3) ಕಾಕನಕೋಟೆ ಕಾಡು ಹೇಗಿದೆ?

 (4) ಅಂತರಜಾಲದ ಉಪಯೋಗಗಳು.

 (5) ಅನೌಪಚಾರಿಕ ಅಭಿವ್ಯಕ್ತಿ ಎಂದರೇನು ತಿಳಿಸಿ.

 (6) ಚರ್ಚಿ – ವ್ಯಾಖ್ಯೆ ಮತ್ತು ಉಪಯೋಗದ ಬಗ್ಗೆ ಬರೆಯಿರಿ.

III .ಈ ಕೆಳಗಿನ ಯಾವುದೇ **ಮೂರು** ಪ್ರಶ್ನೆಗಳಿಗೆ ವಿವರಣಾತ್ಮಕ ಉತ್ತರ ಬರೆಯಿರಿ.   10X3=30

(ಅ) ಹುಲ್ಲಾಗು ಬೆಟ್ಟದಡಿ…… ಕಗ್ಗದಲ್ಲಿ ಮನುಷ್ಯ ಏನಾಗಬೇಕೆಂದು ಮತ್ತು ಸಂಗೀತ ಕಲೆಯೊಂದು ಸಾಹಿತ್ಯ ಕಲೆಯೊಂದು….." ಕಗ್ಗದಲ್ಲಿ ಕವಿ ಇವೆಲ್ಲ ಮನುಷ್ಯನಿಗೆ ಏಕೆ ಬೇಕೆಂದು ಹೇಳುತ್ತಾರೆ?

(ಆ) ಅಣ್ಣನನ್ನು ಕಾಪಾಡಲು ಯೋಗ ಮಾಡಿದ ಸಾಹಸವನ್ನು ವಿವರಿಸಿ.

         (ಅಥವ)

        ಅತಿಯಾದ ನಗರೀಕರಣಕ್ಕಾಗಿ ಕಾಡುಗಳ ನಾಶದಿಂದ ಪರಿಸರದ ಮೇಲಾಗುವ ಪರಿಣಾಮಗಳ ಬಗ್ಗೆ ಬರೆಯಿರಿ.

 (ಇ) ನೀವು ಕಾಲೇಜಿನಿಂದ ಹೋಗಿಬಂದ ಪ್ರವಾಸದ ಅನುಭವ ಕುರಿತು ನಿಮ್ಮ ಗೆಳೆಯರಿಗೆ ಪತ್ರ ಬರೆಯಿರಿ.

(ಈ) ಕೆಳಗಿನ ವಿಷಯವನ್ನು ಒಂದು ಸೂಕ್ತ ಶೀರ್ಷಿಕೆ ಸಹಿತ 30 ಪದಗಳ ಮಿತಿಯಲ್ಲಿ **ಸಂಕ್ಷೇಪಗೊಳಿ**ಸಿ.

        ನೀಲಾಂಬರ ದ್ವೀಪ. ಇದೊಂದು ಸುಂದರ ದ್ವೀಪ. ಪ್ರವಾಸಿಗಳಿಗೆ ಸ್ವರ್ಗಸಮಾನ ದ್ವೀಪ. ಈ ದ್ವೀಪ ಹಿಂದೂ ಮಹಾಸಾಗರದ ದಕ್ಷಿಣಕ್ಕಿರುವ ಆರು ದ್ವೀಪ ಸಮೂಹದಲ್ಲಿ ಮಧ್ಯದಲ್ಲಿ ಹುಣ್ಣಿಮೆ ಚಂದ್ರನಂತೆ ಕಂಗೊಳಿಸುತ್ತಿರುವ ದೊಡ್ಡ ದ್ವೀಪ. ಈ ದ್ವೀಪ ಒಂದು ಭಾಗದಲ್ಲಿ ಹಸಿರು ಚಾದರ ಹಾಸಿದಂತೆ ಸಮತಟ್ಟಾದ ಹುಲ್ಲುಗಾವಲು. ಇನ್ಸ್ಮೊಂದು' ಪಕ್ಕ ಬಗೆಬಗೆಯ ಹಣ್ಣುಗಳ ಮತ್ತು ಹೂವುಗಳ ಗಿಡಗಳು ಮತ್ತು ಅಡಿಕೆ, ಮಾವು, ಮೆಣಸು, ಏಲಕ್ಕಿ, ಲವಂಗದಂತಹ ಗಿಡ–ಮರಗಳಿಂದ ಕೂಡಿದೆ.ಈ ದ್ವೀಪದ ಮಧ್ಯೆ ಕಿರೀಟದಂತೆ ನಮ್ಮ ಉದಕಮಂಡಲದಂತಿರುವ ಹಸಿರಿನ ಬೆಟ್ಟ, ನಿಸರ್ಗದತ್ತ ಹೂವುಗಳ ಗಿಡಗಳಿಂದ ಪುಷ್ಪೋದ್ಯಾನದಂತಿದೆ. ಪ್ರಕೃತಿಯೇ ನಿರ್ಮಿಸಿರುವ ತಿಳಿನೀರಿನ ಸುಂದರ ಕೊಳ ಈ ಬೆಟ್ಟದ

ಆಕರ್ಷಣೆಯಾಗಿದೆ. ಹೀಗಾಗಿ ಈ ದ್ವೀಪ ಪ್ರವಾಸಿಗರಿಗೆ ಅಪಾರ ಆಕರ್ಷಕ ತಾಣವಾಗಿದೆ. ಇಲ್ಲಿನ ಜನ ಸಹ ಸೌಜನ್ಯಶೀಲರು. ಸೃಷ್ಟಿಯ ಶೃಂಗಾರವನ್ನೆಲ್ಲ ಒಳಗೊಂಡ ಈ ದ್ವೀಪದ ಮುಖ್ಯ ಕಸುಬು ಕೃಷಿ, ತೋಟಗಾರಿಕೆ ಮತ್ತು ಪ್ರವಾಸೋದ್ಯವಾಗಿರುವುದರಿಂದ, ಇದೊಂದು ಶ್ರೀಮಂತ ದ್ವೀಪವಾಗಿದೆ.

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ಕನ್ನಡ ಪಠ್ಯಕ್ರಮ ರಚನಾ ಹಾಗು ಪಠ್ಯಪುಸ್ತಕ ಸಮಿತಿ

- **ಸಂಪಾದಕೀಯ ಸಮಿತಿ:**

1. ಶ್ರೀ ಟಿ ಎಲ್ ರವೀಂದ್ರ, ಉಪನ್ಯಾಸಕರು, ಸರ್ಕಾರಿ ಜಿ.ಆರ್.ಐ.ಸಿ.ಪಿ ಬೆಂಗಳೂರು.
2. ಶ್ರೀ ಟಿ. ತಿಮ್ಮಪ್ಪ, ಉಪನ್ಯಾಸಕರು(ಆಯ್ಕೆ ಶ್ರೇಣಿ), ಯಾಂತ್ರಿಕ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಪಾಲಿಟೆಕ್ನಿಕ್, ತುಮಕೂರು.

- **ಸಲಹಾ ಸಮಿತಿಯ ಬಾಹ್ಯ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಗಳು.**

1. ಪ್ರೊ. (ಡಾ.) ಡಿ. ಪಾಂಡುರಂಗ ಬಾಬು, ಕುಲಸಚಿವರು, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
2. ಪ್ರೊ. (ಡಾ.) ಅಶೋಕ್ ಕುಮಾರ್ ರಂಜರೆ, ಪ್ರಾಧ್ಯಾಪಕರು, ಪ್ರಸಾರಾಂಗ ವಿಭಾಗ, ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಹಂಪಿ.
3. ಪ್ರೊ. (ಡಾ.) ಕೆ ವೈ ನಾರಾಯಣ ಸ್ವಾಮಿ, ಸಹ ಪ್ರಾಧ್ಯಾಪಕರು, ಸ್ನಾತಕೋತ್ತರ ವಿಭಾಗ, ಸರ್ಕಾರಿ ಕಲಾ ಕಾಲೇಜು, ಬೆಂಗಳೂರು.
4. ಪ್ರೊ. (ಡಾ.) ಜೆ ಬಾಲಕೃಷ್ಣ, ಪ್ರಾಧ್ಯಾಪಕರು ಹಾಗು ಮುಖ್ಯಸ್ಥರು, ಕನ್ನಡ ಭಾಷಾ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ, (ಜಿಕೆವಿಕೆ) ಹೆಬ್ಬಾಳ, ಬೆಂಗಳೂರು.

	Course Title: **INDUSTRIAL MANAGEMENT**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME51T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of English Communication and Discipline Courses

Course Objectives:

1. Technicians of mechanical engineering disciplines are expected to work during most of their career at middle level. They are also expected to deal with workforce and management problems.
2. In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues.

COURSE OUT COMES

On successful completion of the course, the students will be able to:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Interpret given organization structure, and acquire major management skills, familiarize with different leadership styles	*R/U/A*	2,8,9	**08**
CO2	List stages in product design, and explain different types of plant layout, Production modes and PPC functions	*R/U/A*	2,4	**08**
CO3	Explain material requirement planning and store keeping procedure and analyze importance of inventory control	*R/U/A*	2,4	**11**
CO4	Explain the need of Total Quality management and appreciate the usage of TQM tools in quality control	*R/U/A*	2,4	**09**
CO5	Explain the different types of Plant maintenance and measures and procedure observed in industry towards safety	*R/U/A*	2,5	**08**
CO6	Appreciate the social responsibilities of engineer and ways to protect our environment	*R/U/A*	2,6	**08**
			Total Sessions	**52**

Legend: R; Remember, U: Understand A: Application

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
INDUSTRIAL MANAGEMENT	**0**	**03**	**00**	**02**	**01**	**01**	**00**	**01**	**01**	**00**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks Weightage	Weightage (%)
			R	U	A		
1	BASICS OF MANAGEMENT	08	05	05	10	20	13.79
2	PRODUCTION MANAGEMENT	08	05	05	10	20	13.79
3	MATERIALS MANAGEMENT	11	05	10	20	35	24.16
4	TOTAL QUALITY MANAGEMENT	09	05	05	20	30	20.68
5	PLANT MAINTENANCE AND INDUSTRIAL SAFETY	08	05	05	10	20	13.79
6	SOCIAL ISSUES AND THE ENVIRONMENT	08	05	05	10	20	13.79
	Total	52	30	35	80	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I : BASICS OF MANAGEMENT   08Hrs

Management - Definition – Administration- Definition – Henry-Fayol's principles of management- Business Organisation-Types- Proprietorship-Partnership- Joint stock- Co-operative Society-Advantages and disadvantages -Functions of Management – Planning-Definition-Functions-Organisation-Definition- types of organisation –Line-Functional-Line &staff-advantages and disadvantages- Leadership -Types –Quality of good leader-Motivation - Maslow's Theory of Motivation -Hierarchy of needs- Communication - Process of Communication – Barriers for effective communication.

UNIT II : PRODUCTION MANAGEMENT   08Hrs

Concept of project work - Project planning -Market survey- Project capacity-selection of site for project- Plant layout-Types of Plant layout- Product design-Stages in product design-drawing-Specifications-Material   requirement-operation-Planning-Production-definition-Job, Batch & Mass production with their advantages and disadvantages-Productivity-definition-factors to improve productivity- Production planning and Control (PPC)-definition-Functions of PPC- planning, routing, scheduling, dispatching and Inspection-Introduction to CPM and PERT –Comparision.

UNIT III : MATERIALS MANAGEMENT   11Hrs

Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store management-Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control
Enterprise resource planning - concept, features and applications.- Material Requirement Planning (MRP)-concept, applications -Just in Time (JIT)-concept and benefits-Supply chain management-concept and benefits –FIFO(first in first out) concept-definition.

UNIT IV: TOTAL QUALITY MANAGEMENT   09 Hrs

Quality–Concept-Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection-Different types of inspection
 Total Quality Management-Meaning- Principles of total quality management-PDCA cycles-Quality Circles-definition-Function.
TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S- Kaizen, and Six-sigma
Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.

UNIT V: PLANT MAINTENANCE AND INDUSTRIAL SAFETY   08 Hrs

Plant maintenance-Definition -Types of maintenance-Preventive maintenance- Break down maintenance-Advantages and disadvantages- Total Productive Maintenance-Meaning-benefits of TPM -Tools of TPM- planned maintenance and predictive maintenance.
Industrial safety –Meaning - Accident- causes for accident- Direct and indirect losses due to an accident-Personal protective devices for preventions of accidents-Safety department- role of safety officer – safety supervisor -safety committee – Fire prevention and Protection- Fire triangle-principles of fire extinguishing- various classes of fire- A, B,C, D types of fire extinguishers

UNIT VI: SOCIAL ISSUES AND THE ENVIRONMENT   08 Hrs

Environment - Definition and scope-Solid waste management: causes, effects and control measures of municipal solid wastes (hospital wastes, hazardous wastes and e-wastes)- Water conservation and rain water harvesting. Climate change: global warming, acid rain, ozone layer depletion.-environment and human health-role of information technology in environment and human health

📚 TEXT BOOKS AND REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Industrial Organization and Engineering Economics	T.R.Banga & S C Sharma	Khanna.Publishers
2.	Industrial management and organizational behavior	K.K.Ahuja	-
3	Industrial management and engineering economics	O.P.khanna	Khannapublishers
4.	Production and operations management	-Dr .K.Aswathappa and Dr.Sreedhar Bhatt	Himalaya publishers
5	Safety Management in Industry	Krishnan.N V	Jaico Publishing House, Bombay, 1997
6	Total Quality Management	S Raja Ram, Shivashankar	-
7	Project planning and control with PERT&CPM	By Dr.P.C. PUNMIA & K.K.KHANDELWAL	LP Publication, New Dhelli

LIST OF SOFTWARES/ LEARNING WEBSITES:

1. www.youtube.com/watch?v=SF53ZZsP4ik
2. www.youtube.com/watch?v=iPZlQ3Zx5zc

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	BASICS OF MANAGEMENT	Showing charts, presentations, Video movies
2	PRODUCTION MANAGEMENT	Presentations, Video movies, Expose to real life industries situation, industrial visits
3	MATERIALS MANAGEMENT	Discussions, real life industries situation, industrial visits. Expose to practiced procedures
4	TOTAL QUALITY MANAGEMENT	Teaching, Presentations, Industrial visits, movies.
5	PLANT MAINTENANCE AND INDUSTRIAL SAFETY	Industrial visits, movies
6	SOCIAL ISSUES AND THE ENVIRONMENT	Discussions, real life industries situation, industrial visits

SUGGESTED LIST OF STUDENT ACTIVITIES

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Each student will give an activity to prepare Comparative statement, Placing the purchase order with necessary terms and conditions
2	Given the data, prepare the scheduling using Gantt chart.
3	Each student will give an activity to visit local municipality garbarage plant, how the

4

	garbarage has been segregated. List the harm full effects of your local garbarage dump yard on the nearby environment
4	Identify any one product ,being manufactured in local industry, Study the process they are following for manufacturing the product, submit hand written report
5	Visit a nearby industry, make a report on Plant layout, type of production, quality system is put in practice and quality tools they are using in work place
6	Motivate student to take case study on plant maintenance of nearby industry, observe what type of maintenance they undertake in their industry.
7	Each student should prepare a detailed project report on selected product.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student Activities	05	Activity sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaire	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier*: *The following documents to be verified by CIE verifier at the end of semester

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

• MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

RUBRICS MODEL

	RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	VSEM	**INDUSTRIAL MANAGEMENT**	20
	Year: 2016-17	Course code:15ME51T	

Name of Course coordinator :	Topic: Units:1,2	**CO: 1,2**

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	List the barriers for effective communication. OR List the advantages and limitations of planning.	5	R	1	2,9
2	Develop the line diagram to suit a Functional organisation for pharmaceutical industry.	5	A	1	2
3	Explain job production and mention its advantages and disadvantages OR Explain routing procedure	5	U	2	2
4	Identify the factors to be considered to improve productivity in an organisation.	5	A	2	2

Directorate Of Technical Education, Karnataka State   15ME51T   MECH. ENGG

V Semester Diploma Examination
INDUSTRIAL MANAGEMENT

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any <u>**SIX**</u> from Part A and any <u>**SEVEN**</u> from Part B

Part A   6x5=30 marks

1. Define planning and mention objectives of planning
2. Explain briefly the process of communication
3. Define planning and mention the functions of planning
4. Explain batch production and mention its advantages and disadvantages
5. List the duties of purchasing officer
6. List the objectives of plant maintenance
7. Explain break down maintenance and mention its advantages and disadvantages
8. List the effects and control measure for global warming
9. Explain the factors affecting for climate change

Part B

1. Illustrate the business organisation and explain Proprietorship organisation.
2. What are the duties and responsibilities of chief inspector
3. Develop the specimen copy for preparation of comparative statement
4. List the applications of Material Requirement Planning (MRP)
5. Explain centralized stores and mention its advantages & disadvantages
6. Illustrate Histogram with graphical representation
7. Illustrate ISO 9000–Requirements and Benefits
8. Explain the duties, functions and responsibilities of plant maintenance department
9. What are the causes and effects of environmental pollution
10. a) Define quality control and mention the objectives of quality control
    b) Explain 5S house keeping

MODEL QUESTION BANK

V- Semester Diploma Examination

INDUSTRIAL MANAGEMENT

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO-1: Interpret given organization structure, and acquire major management skills, familiarize with different leadership styles.

Remember

1. List Henry Fayol's principles of management
2. List the types of Business Organization
3. Define sole proprietorship and list advantages and disadvantages of proprietorship.
4. List the applications of proprietorship
5. Define Partnership Organization and mention the applications of Partnership Organization
6. List the advantages and disadvantages of Partnership Organization
7. List the advantages and disadvantages of Joint Stock Company
8. List the advantages and disadvantages of Co-operative society
9. Define planning and mention objectives of planning
10. List the advantages and limitations of planning
11. Define organization and list the types of organization.
12. Define leadership and explain types of leaders
13. List the qualities of good leader
14. Define motivation and state Maslow's theory of motivation
15. Define communication and mention the elements of communication
16. What are the barriers for effective communication
17. What are the functions of management

Understanding

1. Explain management
2. Explain administration
3. Explain the formation of partnership and List the types of partners for Partnership Organization
4. Explain about Joint Stock company
5. Explain two types of Joint Stock Company a. Private limited company and b. private limited company
6. Explain Co-operative society and state the objectives of Co-operative society
7. Explain line organization and mention its advantages and limitations.
8. Explain functional organization and mention its advantages and limitations.

9. Explain Line & staff organization and mention its advantages and limitations.
10. Explain the process of communication

Application

1. Apply the reasons for Proprietorship organisation best suit for small business organisation.
2. Apply the reasons for partnership organisation best suit for small business organisation.
3. Identify the requirements to start - Joint stock organisation.
4. Select best - Co-operative Society organisation for societal needs
5. Develop Line organisation with its advantages.
6. Develop Line &staff organisation with its advantages
7. Develop Functional organisation with its advantages

CO-2: List stages in product design, and explain different types of plant layout, Production modes and PPC functions

Remember

1. Define production and explain the needs for production
2. Define productivity
3. List the factors to improve productivity
4. Define production-planning and control and mention its needs
5. Define planning and mention the functions of planning
6. Define scheduling and explain master schedule
7. Define scheduling and explain manufacturing schedule
8. Define despatching and mention its types
9. List the functions of despatching
10. Define inspection and mention the objects of inspection
11. What are the inspection standards
12. List the functions of inspection department
13. Which are the types of Inspection
14. Define PERT & CPM
15. What are the duties and responsibilities of chief inspector

Understanding

1. Explain job production and mention its advantages and disadvantages.
2. Explain batch production and mention its advantages and disadvantages.
3. Explain mass production and mention its advantages and disadvantages.
4. Explain routing.
5. Explain centralised despatching.
6. Explain decentralised despatching.
7. Explain centralised inspection and mention its advantages and disadvantages
8. Explain Floor Inspection and mention its advantages and disadvantages
9. Explain Patrolling Inspection and mention its advantages and disadvantages

10. Explain the role and application of PERT and CPM for project scheduling

Application
1. Identify the factors for routing
2. Select the functions of PPC
3. Select the functions of despatching
4. Identify the factors affecting the productivity.

CO-3: Explain material requirement planning and store keeping procedure and analyze importance of inventory control

1. **Remember**
2. Define material management and mention its functions
3. Define purchase and mention the objects of purchasing department
4. What are the duties of purchasing officer
5. Define the terms and forms used in purchase department
6. Define tender
7. Define storekeeping and explain the purpose of store keeping
8. List the classifications of store
9. Define bin card and write the specimen copy of bin card
10. Define store ledgers and write the codification of stores
11. List the advantages of good store keeping
12. What are the advantages and disadvantages of inventory control
13. List the benefits of Just in Time (JIT)
14. What are the benefits of Supply chain management

Understanding
1. Explain the different methods of purchasing
2. Explain different types of tender
3. Explain centralized stores and mention its advantages & disadvantages
4. Explain decentralized stores and mention its advantages & disadvantages
5. Explain the methods of storing
6. Explain material return note and write the specimen copy of material return note
7. Explain stock or inventory control and mention the functions of inventory control
8. Explain the steps in inventory control
9. Infer the concept and features of Enterprise resource planning
10. Illustrate the concept of Material Requirement Planning (MRP)
11. Explain the concept Just in Time (JIT)
12. Explain the concept of Supply chain management
13. Explain First in First out Method
14. Outline the advantages AND disadvantages of FIFO

Application

1. Identify the functions of purchasing department
2. Select the procedure for purchasing the materials
3. Develop the purchase requisition format
4. Develop the specimen copy for preparation of comparative statement
5. Develop the Performa of purchase order
6. Construct the layout of stores organization and list the duties of store keeper
7. Develop the specimen copy of materials issue requisition form
8. Identify the applications of Enterprise resource planning
9. Identify the applications of Material Requirement Planning (MRP)

CO-4: Explain the need of Total Quality management and appreciate the usage of TQM tools in quality control

Remember

1. Define quality and list the factors affecting quality
2. Define quality control and mention the objectives of quality control
3. List the advantages of quality control
4. Define Total quality management
5. Define the principles of Total quality management
6. Define quality circle and mention its functions
7. list different types of control charts
8. Define flow charts
9. What are the benefits in implementing 5S
10. List the benefits of ISO 14000

Understanding

1. Explain continuous process improvement in TQM
2. Explain basic concepts of TQM
3. Explain the benefits of TQM
4. Explain about PDCA cycles
5. Explain about control charts
6. Explain 5S house keeping
7. Explain Kaizen principle
8. Explain about Six Sigma concepts
9. Illustrate the Need for ISO 9000- ISO 9000-2000 Quality System
10. Explain about ISO 9000 Family

Application

1. Identify the functions of quality control department
2. Develop Histogram with graphical representation
3. Construct Pareto charts with graphical representation
4. Construct and Illustrate the Cause-and-Effect Diagram

5. Identify QS 9000 – ISO 14000 –Requirements and Benefits
6. Identify the Obstacles associated with TQM Implementation

CO-5: Explain the different types of Plant maintenance and measures and procedure observed in industry towards safety

1. **Remember**
2. Define plant maintenance and explain its needs
3. List the objectives of plant maintenance
4. List the types of maintenance
5. List personal protective devices for preventions of accidents
6. Define safety department and mention the objectives of safety department

Understanding
1. Explain Preventive maintenance
2. Explain Corrective maintenance
3. Explain Predictive maintenance
4. Explain scheduled maintenance
5. Explain plant maintenance schedule
6. Explain break down maintenance and mention its advantages and disadvantages
7. Explain Total Productive Maintenance
8. Explain planned maintenance
9. Explain industrial safety and mention the needs and importance of safety
10. Explain industrial accidents and accident sequences
11. Summarise the Direct and indirect losses due to an accident
12. Explain the role of safety officer , safety supervisor and safety committee
13. Explain Fire prevention and Protection
14. Explain detection and prevention of fire, fire alarms and fire extinguisher

Application
1. Identify the duties, functions and responsibilities of plant maintenance department
2. Select the benefits of Total Productive Maintenance
3. Develop the Organization Structure for TPM Implementation.
4. Identify the types of fire and construct fire triangle.
5. Identify the causes for accident

CO-6: Appreciate the social responsibilities of engineer and ways to protect our environment

1. **Remember**
1. Define environment and explain the scope of environment
2. What are the effects of municipal solid wastes.
3. List the advantages of rain water harvesting.

4. Define climate change.
5. List the effects and control measures for global warming.
6. List the effects and control measures of acid rain.
7. List the effects and control measures for ozone layer depletion.
8. Relate the role of information technology in environment and human health.

Understanding

1. Explain Solid waste management.
2. Explain the factors affecting for climate change.
3. Explain global warming.
4. Explain acid rain.
5. Explain ozone layer depletion.
6. Interpret about environment and human health.

Application

1. Identify the causes and effects of environmental pollution.
2. Plan the control measures of municipal solid wastes.
3. Identify the causes of municipal solid wastes
4. Making use of rain water harvesting technique plan water conservation for future.

	Course Title: **APPLIED THERMAL ENGINEERING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME52T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of Engineering Mathematics, Applied Science and Basic Thermal Engineering

Course Objectives:

1. This course will provide the basic knowledge of thermal engineering which will function as foundation in applications in major fields of mechanical engineering and technology notably in steam and nuclear power plants.
2. This course would develop knowledge and skills related to boilers, boiler mountings and accessories, compressors, heat exchangers, steam turbines etc. This course is thus very important for mechanical engineer.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Determine steam properties and dryness fractions.	*R/U/A*	1,2	**10**
CO2	Classify and explain boilers, boiler mountings and accessories	*R/U/A*	2	**09**
CO3	Identify the elements and processes of steam condensers and cooling towers And working of steam Nozzles	*R/U/A*	1,2	**11**
CO4	Understand the working of steam Turbines	*U/A*	1,2	**10**
CO 5	Operate air compressors and observe the parameters affecting the performance	*R/U/A*	1,2	**06**
CO6	Know the mechanism of refrigeration, and its types and different air conditioning system	*R/U*	2	**06**
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application An: Analysis

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
APPLIED THERMAL ENGINEERING	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks Weightage	Weightage (%)
			R	U	A		
1	**FORMATION OF STEAM**	10	5	5	20	30	20.69
2	**STEAM BOILERS**	10	5	10	10	25	17.25
3	STEAM CONDENSERS, COOLING TOWERS **AND STEAM NOZZELS**	10	10	10	10	30	20.69
4	**STEAM TURBINES**	10	-	10	20	30	20.69
5	AIR COMPRESSORS	06	-	5	10	15	10.34
6	**REFRIGERATION AND AIR CONDITIONING**	06	5	10	-	15	10.34
	Total	52	25	50	70	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: FORMATION OF STEAM   **10 Hrs**

Concept of two phase system - Formation of steam- Definition and representation of wet steam, dry steam, saturated steam and superheated steam on T-H Diagram.

Concept and determination of dryness fraction-Degree of superheat-Latent heat-sensible heat, enthalpy-entropy-Internal energy-External work of evaporation and specific volume of steam-Use of Steam tables and Mollier chart- (Heat Entropy Chart).-Numerical examples based on above.

Steam vapour cycles-Carnot cycle- Schematic diagram –Representation on PV & T-S diagram-Rankine cycle-Schematic diagram- Representation on PV & T-S diagram-(No numerical Problems on steam vapour cycles)

Steam Calorimeters- Barrel Calorimeter, Separating Calorimeter, Throttling Calorimeter and combined Separating & Throttling calorimeters.-Limitations of Calorimeter-(No numerical Problems on Calorimeters).

UNIT II: STEAM BOILERS   10 Hrs

Steam boiler-Concept-definition-Indian Boilers Regulation (IBR)- Classification of boiler – function of boiler- Low pressure boilers- Sketch and working of Cochran boiler- Babcock and Wilcox boiler-Merits and demerits- High pressure boilers- Sketch and working of Lamont and Benson boiler- Merits and demerits- Comparison of water tube and fire tube boilers- Boiler mountings and accessories, Boiler draught system-concept and classification -steam jet draught.

UNIT III: STEAM CONDENSERS, COOLING TOWERS & NOZZELS   10Hrs

Introduction-Steam condenser-Concept-Classification-Functions- Jet condensers and surface condensers-working-merits and demerits of surface condensers over jet condensers -Cooling towers- Classification, function and working.

Steam nozzles-concept-Types-Flow of steam through convergent-divergent nozzle-Friction in a nozzle-Discharge of steam through nozzles-Critical pressure ratio (no derivation)-Methods of calculation of cross sectional areas at throat and exit for maximum discharge-Effect of friction in nozzles-Supersaturated flow through nozzle- Numerical on nozzles using Mollier Chart only.

UNIT IV: STEAM TURBINES   10 Hrs

Steam turbine –concept- classification - Working principle with line diagram of a simple De-Laval turbine – velocity diagram of impulse turbine- Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, nozzle efficiency- Compounding of steam turbine-Need for compounding- Pressure compounding.- Velocity compounding- Pressure velocity compounding. Problems on single stage impulse turbines (graphical method only) – Concept of reaction turbines – Parson's – Delaval (No numerical).

UNIT V: AIR COMPRESSOR   06 Hrs

Air compressor-concepts, functions, classification and applications- Single stage reciprocating air compressor- construction and working (with line diagram) Expression for work done and power required by single stage reciprocating compressor (without derivation), Simple problems on work done and power required.

Multi stage compression – advantages of multistage compression-Rotary Compressors - working of rotary Compressor-Difference between reciprocating and rotary compressors - concept of screw compressor (oil free).

UNIT VI: REFRIGERATION AND AIR CONDITIONING   06 Hrs

Refrigeration - Definition -Unit of refrigeration -Coefficient of performance (COP)-Vapour compression refrigeration with flow diagram-Vapour absorption refrigeration with flow diagram- Refrigerants –Types- Factors affecting the choice of refrigerants- properties of good refrigerants.

Psychrometry- definition-Psychrometric terms - dry air, saturated air, dry bulb temperature-Wet bulb temperature, dew point temperature, relative humidity, absolute humidity, specific humidity.

Air Conditioning- classification-winter Air Conditioning-Summer Air conditioning-Year round air conditioning-

REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Heat Engines	Pandya and Shah	Charotar Publishing House
2.	Thermodynamics and Heat power Engg.	Mathur and Mehta	Tata Mcgraw- Hill
3	A Text book of Thermal Engineering	R S Khurmi& J K Gupta	S Chand
4.	Thermal Engineering	P.L. Ballaney	Khanna.Publishers
5	Thermal Engineering	A. S. Sarao	SatyaPrakashan
6	Thermal Engineering	R K Rajput	Laxmi.Publications
7	Practical Thermodynamics	G D Rai	Khanna Publisher
8	Thermal Engineering	Mahesh M Rathore	Mcgraw- Hill Education
9	Basic and applied thermodynamics	P K Nag	McGraw Hill education

LIST OF SOFTWARES/ LEARNING WEBSITES:

a. http://www.nptel.iitm.ac.in/video.php?subjectId=112105123 (IIT-B Video lectures)

b. http://www.thermofluids.net/

c. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv301-Page1.htm

d. http://www.grc.nasa.gov/WWW/k-12/airplane/thermo.html

e. http://www.youtube.com/watch?v=Xb05CaG7TsQ

f. http://www.youtube.com/watch?v=aAfBSJObd6Y

g. http://www.youtube.com/watch?v=DHUwFuHuCdw

h. http://www.youtube.com/watch?v=kJlmRT4E6R0

i. http://www.youtube.com/watch?v=GKqG6n6nAmg

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Interpret steam tables, mollier chart and relationship between different thermodynamic properties.
2	Prepare Mollier charts and show different regions.
3	Visit to sugar factory / Dairy / steam power plant, Prepare Hand written Report on specifications of boiler and list of mountings and accessories with their functions, safety measured observed.
2	At least one visit of any power plant/ industry, student should observe the operational aspects, safety in handling boiler, air compressor, heat exchanger, cooling tower, condenser etc. and submit hand written report.
3	Collect/ the details and specifications of various types of Steam condensers/Cooling towers used in industry.
4	Collect/ download product catalogues with specification of various types of Air compressors used in industry.

5	Each student should prepare a detailed report showing the construction/components/Working of Domestic refrigerator or Air Conditioners

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	FORMATION OF STEAM	lectures and Power point presentations/ Video/ Video movies
2	STEAM BOILERS	Lectures/Presentations, Showing charts, Video movies, Expose to real life industries situation, industrial visits
3	STEAM CONDENSERS, COOLING TOWERS AND STEAM NOZZELS	Lectures/Presentations, Showing charts, Video movies, Expose to real life industries situation, industrial visits
4	STEAM TURBINES	Lectures/Presentations, Showing chart, Expose to real life industries situation, industrial visits.
5	AIR COMPRESSORS	Lectures/Presentations, Showing chart,
6	REFRIGERATION AND AIR CONDITIONING	Lectures/Presentations, Showing chart, Expose to real life industries situation, industrial visits

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activities sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
RUBRICS FOR ACTIVITY(5 Marks)						
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	VSEM	**APPILED THERMAL ENGG.**	20
	Year: 2016-17	Course code:15ME52T	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Explain Barrel type Steam Calorimeters with a neat sketch. OR Explain Separating type Steam Calorimeters with a neat sketch	5	U	2	2
2	Make use of the given data find the quantity of heat required to produce 1kg of steam at a pressure of 6 bar at a temperature of 25^0C, under the following conditions. a)When the steam is wet having a dryness fraction 0.9, b)when the steam is dry saturated, c)when it is superheated at a constant pressure at 250^0C assuming the mean specific heat of superheated steam to be 2.3 kJ/kg^{0}K.	5	A	1	2
3	Choose the different system of producing draught in a boiler and mention their advantages and disadvantages	5	A	2	2
4	Explain the various types of draughts used in usual practice. OR Compare the advantages of high pressure boiler over low pressure boiler.	5	U	2	2

V- Semester Diploma Examination

Course Title: **APPILED THERMAL ENGINEERING**

Time: **3 Hours**]   [Max   Marks**:   100**

Note: Answer any **SIX from PartA** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. List the advantages of superheated steam
2. Explain Barrel type Steam Calorimeters with a neat sketch

3. List the various types of draughts used in usual practice.
4. List the different types of steam - condensers.
5. List the function of cooling tower in a modem condensing plant
6. Explain the Working of simple De-Laval turbine with line diagram
7. Summarise the advantages and disadvantages of velocity compounded impulse turbines.
8. List the desirable properties of a secondary refrigerant.
9. Explain Single stage reciprocating air compressor with line diagram

PART-B   7x10=70 marks

1. Steam at 18 bar and dryness 0.9 is heated at constant pressure until dry and saturated. Find the increase in volume, heat supplied and work done per kg of steam. If the volume is now kept constant, find how much heat must be extracted to reduce the pressure to 14 bar.
2. Make use of the steam table,find the following : (i) Enthalpy and volume of 1 kg of steam at 12. 1 bar and dryness fraction 0.9, and (ii) Enthalpy and volume of 1 kg of steam at 12. 1 bar and 225'C. Take the specific heat at constant pressure for superheated steam as 2.1 kJ/kg K.
3. i) Compare high pressure boiler and low pressure boiler
    ii) Explain the function of the safety valve
4. Outline the sketch and explain the working of a La-mount boiler
5. Outline the sketch and explain counter-flow low level jet condenser and list the advantages.
6. A convergent-divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 7 bar and 180^0C and discharge takes place against the back pressure of 1 bar. The expansion up to throat is isentropic and the frictional resistance between throat and exit is equivalent to 63 kJ/kg of steam. The approach velocity to the nozzle is 75 m/s and throat pressure is 4 bar. Estimate (a) Suitable areas of throat and exit, (b) Overall efficiency of the nozzle based on enthalpy drop between inlet pressure, temperature and exit pressure.
7. An impulse turbine with a single row wheel is to develop 99.3 kW, the blade speed being 150 m/sec. A mass of 2 kg of steam per second is to flow from the nozzles at a speed of 350 m/sec. The velocity coefficient of the blades may be assumed to be 0.8 while the steam is to flow axially after passing through the blades ring. Determine the

nozzle angle, and the blade angles at inlet and exit assuming no shock. Estimate also the diagram efficiency of the blading.

8. The steam leaves the nozzle of a single-stage impulse wheel turbine at 900 m/sec. The nozzle angle is 20°, the blade angles are 30° at inlet and outlet, and friction factor is 0.8. Calculate : (a) the blade velocity, and (b) the steam flow in kg per hour if the power developed by the turbine is 257'kW.

9. a) Explain winter Air Conditioning with neat sketch.
   b) Explain Summer Air conditioning with neat sketch

10. It is desired to compress 17m^3 of air per minute from 1 bar (100 kN/m2) and 21'C to a delivery pressure of 7 bar (700 kN/m^2) in a single-stage, single-acting air compressor. Calculate the power required to drive the compressor and the heat rejected duhng compression to cooling water if the compression is (a) Isentropic (y = 1.4 for air), and (b) Isothermal.

Diploma in Mechanical Engineering
V Semester
Course title: APPILED THERMAL ENGINEERING

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They has to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO-1: Determine steam properties and dryness fractions.

REMEMBER

1. What is meant by saturation temperature and saturation pressure?
2. Define the following terms : (i) Saturated steam, (ii) Dry saturated steam, (Hi) Wet steam, (iv) superheated steam, (v) Dryness fraction of steam, (vi) Specific volume of steam, and (vii) Saturated water.
3. List the advantages of superheated steam
4. Define Internal energy of steam.

UNDERSTAND

1. Explain the process of formation of steam at a constant pressure from water.
2. Explain how the wet steam, dry saturated steam and superheated steam is produced.
3. Explain T-H diagram during steam formation.
4. Explain steam tables and their uses.
5. Explain Carnot cycle with Sketch
6. Explain with sketch Rankine cycle
7. Explain Barrel type Steam Calorimeters with a neat sketch.
8. Explain Separating type Steam Calorimeters with a neat sketch
9. Explain Throttling type Steam Calorimeters with a neat sketch
10. Explain combined Separating & Throttling type Steam Calorimeters with a neat sketch
11. Compare enthalpy and internal energy of steam
12. Outline the Limitations of Calorimeter.
13. Explain the following terms : (i) Saturated steam, (ii) Dry saturated steam, (Hi) Wet steam, (iv) superheated steam, (v) Dryness fraction of steam, (vi) Specific volume of steam, and (vii) Saturated water.
14. Explain the following terms as referred to steam : (i) Enthalpy of water, (ii) Enthalpy of evaporation, (iii) Superheat, (iv) Specific volume, and (v) Enthalpy of dry saturated steam.
15. Compare saturated steam and dry saturated steam.

APPLICATION

1. Make use of the given data find the quantity of heat required to produce 1kg of steam at a pressure of 6 bar at a temperature of 25^0C, under the following conditions.
   a)When the steam is wet having a dryness fraction 0.9, b)when the steam is dry saturated, c)when it is superheated at a constant pressure at 250^0C assuming the mean specific heat of superheated steam to be 2.3 kJ/kg^{0}K.
2. Steam enters an engine at a pressure of 12bar with 67^0C of superheat. It is exhausted at a pressure of 0.15bar and 0.95dry. Find the drop in enthalpy of steam.

3. Make use of the given data find the internal energy of 1kg of superheated steam at a pressure of 10bar and 280^0C.
   If this steam be expanded to a pressure of 1.6bar and 0.8dry, determine the change in internal energy. Assume specific heat of superheated steam as 2.3 kJ/kg^{0}K.

4. A vessel contains 20kg of steam at a pressure of 8 bar. Find the amount of heat, which must be rejected, so as to reduce the quality of steam in the vessel to be 70%.

5. Steam at 18 bar and dryness 0.9 is heated at constant pressure until dry and saturated. Find the increase in volume, heat supplied and work done per kg of steam. If the volume is now kept constant, Analyze how much heat must be extracted to reduce the pressure to 14 bar.

6. Analyze how much heat is needed to convert 5 kg of water at 40'C into 90 per cent dry (or 10 per cent wet) steam at 5 bar (500 kPa) ? Take specific heat of water as 4. 187 kJ/kg K.

7. Analyze how much heat is needed to convert 4 kg of water at 20'C into steam at 8 bar (800 kPa) and 200'C. Take kp of superheated steam as 2.1 kJ/kg K and specific heat of water as 4.187 kJ/kg K.

8. Make use of the given data ,Find the volume of one kilogram of steam at a pressure of 15 bar (15 MPa) in each of the following cases : (i) when steam is dry saturated, (ii) when steam is wet having dryness fraction of 0.9, and (iii) when steam is superheated, the degree of superheat being 40'C.

9. Analyze the condition of steam in each of the following cases : (i) at a pressure of 10 bar and temperature 200'C, (ii) at a pressure of 8 bar and volume 0.22 m /kg, and (iii) at a pressure of 12 bar, if 2,688 kJ/kg are required to produce it from water at 0 'C.

10. Utilize steam table,and find (i) Enthalpy and volume of 1 kg of steam at 12. 1 bar and dryness fraction 0.9, and (ii) Enthalpy and volume of 1 kg of steam at 12. 1 bar and 225'C. Take the specific heat at constant pressure for superheated steam as 2.1 kJ/kg K.

11. Wet steam of mass 25 kg and occupying a volume of 0.49 m at 75 bar has a total heat (enthalpy) increase of 1,500 kJ when superheated at constant pressure. Determine : (i) Initial quality of steam, (ii) Final quality (degree of superheat) of steam, and (HI) Increase in volume of steam after superheating. Assume kp for the superheated steam to be 2-1 kJ/kg K.

12. Steam enters a steam engine at a pressure of 12 bar with 67'C of superheat and is exhausted at 0.15 bar and 094 dry. Calculate the drop in enthalpy from admission to exhaust, and volume of 1 kg of steam at admission and exhaust conditions. Take kp of superheated steam as 2.1 kJ/kg K.

13. Make use of the given data, find the external work done during evaporation, internal latent enthalpy and internal energy per kg of steam at a pressure of 15 bar (1,500 kPa) when the steam is (i) 09 dry, and (ii) dcy saturated.

14. 0.025 m3 of steam at 3.5 bar and dryness fraction 08 is converted into dry saturated steam at 11 bar. By how much are the enthalpy and internal energy changed ?

15. The internal energy of 1 kg of steam at a pressure of 14 bar (1.4 MPa) is 2,420 kJ. Calculate the dryness fraction of this steam. Find the increase in internal energy if this steam is superheated at constant pressure to a temperature of 295'C. Take kp of superheated steam as 2.3 kJ/kg K.

16. Inspect at what fraction of enthalpy of 1 kg of steam at 10 bar and 0.9 dry represents the internal energy ? What is the change in internal energy when the pressure and temperature of this steam is raised to 13 bar and 250'C ? Take kp of superheated steam as 2.1 kJ/kg K.

REMEMBERING

1. Define steam boiler and list its function.
2. List the types of boilers according to various factors
3. List the advantages of a Lancashire boiler
4. List the advantages of Cochran boilers
5. List the advantages and disadvantages of a locomotive boiler.
6. List the advantages and disadvantages of water-tube boilers.
7. List the advantages of water-tube boilers over fire-tube boilers and tank boilers.
8. List the boiler mountings.
9. List the different mountings and accessories with which the Babcock and Wilcox water-tube boiler is fitted
10. List the various types of draughts used in usual practice.

UNDERSTANDING

1. Explain the following terms used in boiler practice : (a) Boiler shell, (b) Fire grate, (c) Furnace, (f) Mountings, (g) Blowing-off
2. Expline the method of obtaining draught in the boiler.
3. Compare 'water-tube' and Fire-tube' boilers.
4. Explain the function of the safety valve .
5. Explain the function of the Fusible plug.
6. Outline the neat sketch of the Babcock and Wilcox water tube boiler.
7. Compare Natural draught and artificial draught.
8. Compare Forced draught and induced draught.
9. Compare how an artificial draught is considered advantageous over a natural draught
10. Explain the terms mechanical draught and balanced draught.
11. Explain the working principle of the steam jet draught.
12. Compare the advantages of high pressure boiler over low pressure boiler.
13. Compare high pressure boiler and low pressure boiler.

APPLICATION

1. Construct neat sketch and explain the Lancashire boiler.

2. Construct neat sketch and explain the Co-chran boiler
3. Construct neat sketch and explain the locomotive boiler.
4. Choose the different system of producing draught in a boiler and mention their advantages and disadvantages.
5. Construct neat sketch and explain the La-mount boiler.
6. Construct neat sketch and explain the working of a Benson boiler

REMEMBERING

1. List the function of a condenser in a modem steam condensing power plant.
2. list the different types of steam - condensers.
3. List the function of cooling tower in a modem condensing plant.
4. Define the term 'Nozzle efficiency.

UNDERSTANDING

1. Outline the Sketch and explain the working of Surface Condenser
2. Outline the Sketch and explain the working of Jet Condenser
3. Construct neat sketch of a barometric jet condenser and explain its working
4. Compare the merits and demerits of surface condensers over jet condensers
5. Construct neat sketch of a counter-flow low level jet condenser and explain its working.
6. Construct neat sketch and explain the operation of an evaporative condenser
7. Construct neat sketch and explain the working of any one type of cooling tower.
8. Explain the function of a steam nozzle. Explain the types of nozzles with sketch.
9. Explain the term critical pressure as applied to steam nozzles.
10. Explain the term "critical pressure" as applied to steam nozzles. Why are the turbine nozzles made divergent after the throat.
11. Explain he causes of supersaturated flow in nozzles.
12. Explain the supersaturated expansion of steam and give some idea of the limits within which this condition is possible.
13. Explain the Types of steam nozzles with neat sketches
14. Explain the Effect of friction on the flow of steam through convergent-divergent steam nozzles.
15. Explain the Effect of supersaturated flow in steam nozzles.

APPLICATION

1. A nozzle is to be designed to expand steam at the rate of 0.10kg/s from 500kpa, 210^0C to 100kpa. Neglect inlet velocity of steam. For a nozzle efficiency of 0.9, determine the exit area of the nozzle.
2. Steam enters a convergent – divergent nozzle at 2 MPa and 400^0C with a negligible velocity and mass flow rate of 2.5 kg/s and it exists at a pressure of 300 kPa. The flow is isentropic between the nozzle entrance and throat and overall nozzle efficiency is 93 percent. Determine (a) throat, and (b) exit areas.
3. In a convergent-divergent nozzle, the steam enters at 15 bar and 300^0C and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for mass-flow rate of 1 kg/s. Assume nozzle efficiency to be 90 percent and C_{ps}= 2.4 kJ/kgK
4. Determine the throat and exit diameters of a convergent-divergent nozzle, which will discharge 820 kg of steam per hour at a pressure of 8 bar superheated to 220 ^{0}C into a chamber having a pressure of 1.5 bar. The friction loss in the divergent portion of the nozzle may be taken as 0.15 of the isentropic enthalpy drop.
5. A convergent-divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 7 bar and 180^0C and discharge takes place against the back pressure of 1 bar. The expansion up to throat is isentropic and the frictional

resistance between throat and exit is equivalent to 63 kJ/kg of steam. The approach velocity to the nozzle is 75 m/s and throat pressure is 4 bar. Estimate (a) Suitable areas of throat and exit, (b) Overall efficiency of the nozzle based on enthalpy drop between inlet pressure, temperature and exit pressure.

6. A turbine having a set of 16 nozzles receives steam at 20 bar and 400 ^{0}C. The pressure of steam at the nozzle exit is 12 bar. If the discharge rate is 260 kg/min and the nozzle efficiency is 90 %, calculate the cross-sectional area at the nozzle exit. If the steam has a velocity of 80 m/s at entry to the nozzle, find the percentage increase in discharge.

7. The steam is supplied to a nozzle at a rate of 1 kg/s from an inlet condition of 10 bar, dry saturated and exit at 1 bar pressure. The efficiency of the nozzle for the convergent portion is 95 percent and that of the divergent portion is 90 percent. Determine (a) throat and exit diameters of nozzle (b) length of nozzle, if divergent cone angle of the nozzle is 14^0. (c) The power in kW correspondence to exit velocity of the steam

8. A convergent-divergent nozzle is required to discharge 350 kg of steam per hour. The nozzle is supplied with steam at 8.5 bar and 90% dry and discharges against a back pressure of 0.4 bar. Neglecting the effect of friction, find the throat and exit diameters.

CO-4: Understand the working of steam Turbines

UNDERSTANDING

1. Compare Impulse and reaction turbines.
2. Explain the principle of working of impulse turbine.
3. Explain the Working of simple De-Laval turbine with line diagram
4. Outline the velocity diagram of a impulse turbine blades.
5. Explain the need for compounding.
6. Explain Blade efficiency and diagram efficiency.
7. Explain why steam turbines are compounded
8. Explain the Pressure compounding with diagrams
9. Explain the Velocity compounding with diagrams
10. Explain the Pressure-Velocity compounding with diagrams.
11. Explain the working of an Impulse reaction turbine.
12. Summarise the advantages and disadvantages of velocity compounded impulse turbines.
13. Explain Parson's reaction turbine.

APPLICATION

1. Steam issues from the nozzle of a simple impulse turbine with a velocity of 900 m/sec. The nozzle angle is 20°, the mean diameter of the blades is 25 cm and the speed of rotation is 20,000 r.p.m. m The mass flow through the turbine nozzles and blading is 0.18 kg of steam per sec. Draw the velocity diagram and derive or calculate the following : (a) Tangential force on blades, (b) Axial force on blades, (c) Power developed by the turbine wheel, (d) Efficiency of the blading, and (e) Inlet angles of

2. The rotor of an impulse turbine is 60 cm diameter and runs at 9,600 r.p.m. The nozzles are at 20° to the plane, of the wheel, and the steam leaves them at 600 m/sec. The blades outlet angle are 30° and the friction factor is 0.8. Calculate the power developed per kg of steam per second and the diagram efficiency.

3. An impulse turbine with a single row wheel is to develop 99.3 kW, the blade speed being 150 m/sec. A mass of 2 kg of steam per second is to flow from the nozzles at a speed of 350 m/sec. The velocity coefficient of the blades may be assumed to be 0.8 while the steam is to flow axially after passing through the blades ring. Determine the nozzle angle, and the blade angles at inlet and exit assuming no shock. Estimate also the diagram efficiency of the blading.

4. The steam leaves the nozzle of a single-stage impulse wheel turbine at 900 m/sec. The nozzle angle is 20°, the blade angles are 30° at inlet and outlet, and friction factor is 0.8. Calculate : (a) the blade velocity, and (b) the steam flow in kg per hour if the power developed by the turbine is 257'kW.

5. The outlet area of the nozzles in a simple impulse turbine is 15-5 err? and the steam leaves them 0.91 dry at 1.4 bar and at 920 m/sec. The blade angles are 30° at inlet and exit, and the blade velocity is 0.25 of the steam velocity at the exit from the nozzle. The friction factor is 0.8. Find : (a) the nozzle angle, (b) the power developed, (c) the diagram efficiency, and (d) the axial thrust on the blading.

6. A single stage impulse rotor has a blade ring diameter of 57.5 cm and rotates at a speed of 10,000 r.p.m. The nozzles are inclined at 20^0 to the direction of motion of the blades and the velocity of the issuing steam is 1050 m/sec. Determine the inlet blade angle in order that the steam shall enter the blades passage without shock. Assume a friction coefficient of the blading equal to 0.85 and that the inlet and outlet angles are equal. Find also: (a) the power developed at the blades for a steam supply of 1,350 kg per hour, (b) the diagram efficiency, and (c) the loss of kinetic energy due to blade friction.

CO5: Operate air compressors and observe the parameters affecting the performance

REMEMBERING
1. List the types of air compressors.
2. List the applications of the air compressor.
3. List the advantages of multi stage reciprocating air compressor.

UNDERSTANDING
1. Explain the uses of compressed air.
2. Classify the air compressor.
3. Explain Single stage reciprocating air compressor with line diagram.
4. Explain multi stage compression with line diagram.
5. Compare Reciprocating compressor with Rotary compressors.
6. Explain with Sketch the operation of a single-stage centrifugal compressor
7. Explain with Sketch the operation of a Screw compressor(oil free).

APPLICATION

1. A single-cylinder, single-acting reciprocating air compressor has a cylinder of 24 cm diameter and linear piston speed of 100 metres per minute. It takes in air at 100 kPa (100 kN/m2) and delivers at 1 MPa (1 MN/rrP), Determine the indicated power of the

compressor. Assume the law of compression to be $pv^{1.25}$ = constant ture of air at inlet is 288 K. Neglect clearance effect.

2. A single-acting, single-stage air compressor developing indicated power of 11 kW, runs at 200 r.p.m. and has a linear piston speed of 100 metres per min. If the suction pressure and temperature are 100 kPa and 15'C respectively and delivery pressure is 1,000 kPa, calculate the dimensions of the compressor cylinder. Assume the law of compression to be $pv^{1.25}$ = constant. Neglect clearance effects.

3. A single-acting, single-stage air compressor is belt driven from an electric motor at 300 r.p.m. The cylinder diameter is 20 cm and the stroke is 24 cm. The air is compressed from one atmosphere to 8 atmospheres and the law of compression is $pv^{1.25}$ = constant. Find the power of the electric motor if the transmission efficiency is 96 per cent and the mechanical efficiency of the compressor is 85 per cent Neglect clearance effect.

4. It is desired to compress $17m^3$ of air per minute from 1 bar (100 kN/m2) and 21'C to a delivery pressure of 7 bar (700 kN/m^2) in a single-stage, single-acting air compressor. Calculate the power required to drive the compressor and the heat rejected duhng compression to cooling water if the compression is (a) Isentropic (y = 1.4 for air), and (b) Isothermal.

CO6: Know the mechanism of refrigeration, and its types and different air conditioning system

REMEMBER

1. Define Refrigeration, Refrigerating effect, Tonne of refrigeration and COP.
2. Name the common refrigerants in use.
3. List the desirable properties of a secondary refrigerant.
4. Define Air Conditioning and list the types of air conditioning.
5. Define: Dry air, Saturated air, Dry bulb temperature, Wet bulb temperature, Dew point temperature, Relative humidity, Absolute humidity, Specific humidity.

UNDERSTANDING

1. Explain Vapour compression refrigeration with flow diagram.
2. Explain Vapour absorption refrigeration with flow diagram.
3. Explain the factors affecting the choice of refrigerants commonly used in refrigerating machines.
4. Explain winter Air Conditioning with neat sketch.
5. Explain Summer Air conditioning with neat sketch.
6. Explain Year round air conditioning with neat sketch.

	Course Title: **MACHINE DESIGN**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME53T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Machine drawing and Workshop Processes

Course Objectives:

This course curriculum provides the knowledge of design process, as well as enables the student to design simple machine components used in small and medium scale industries.

COURSE OUTCOMES

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand the concept of design and behavior of material under varying load conditions, Use of design data books while designing machine components	*R*	2	**04**
CO2	Design of bolts, nuts, and riveted joints subjected to direct stresses and analyze the type of stresses induced under different load conditions	*R/U/A/An*	1,2	**12**
CO3	Design of machine elements subjected to direct and twisting moments and analyze the type of stresses induced under different load conditions	*U/A*	1,2,	**10**
CO4	Design of machine element like Solid Muff Coupling- flange coupling subjected to direct and twisting moments and Knuckle joint-Cotter joint subjected to direct stress and analyze the various modes of failure(with numeric examples)	*A / An*	1,2	**14**
CO5	Design procedure of machine elements subjected to twisting moment and analyze the type of stresses induced in them	*R/U/A*	1,2	**08**
CO6	Know the Principles of design as per ergonomic, and Environmental considerations	*R/U*	2	**04**
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MACHINE DESIGN	2	3	0	0	0	0	0	0	0	0
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.										
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.										
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3										
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2										
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1										
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/MARKS			Marks weightage	weightage (%)
			R	U	A/An/Ev/cre		
1	INTRODUCTION TO DESIGN	04	05	--	--	05	6.89
2	DESIGN OF FASTENERS	12	05	05	30	40	20.68
3	DESIGN OF SHAFTS, KEYS	10	--	05	15	20	17.27
4	DESIGN OF SIMPLE MACHINE PARTS	14	---	----	50	50	34.48
5	DESIGN OF SPRINGS	08	--	05	15	20	13.79
6	ERGONOMICS & AESTHETIC CONSIDERATION IN DESIGN	04	05	05	--	10	6.89
	Total	52	15	20	110	145	100

UNIT I: INTRODUCTION TO DESIGN   04Hrs

Machine Design–Classification-General considerations-Load-stress-strain,-stress-strain diagram for mild steel- Bending and torsion stress equations - Factor of Safety and Factors governing selection of factor of Safety- Stress Concentration – Causes & Remedies-Designation of materials as per IS- using of design data book – Concept of Theory of failure-types.

UNIT II: DESIGN OF FASTENERS   12Hrs

Stresses in Screwed fasteners- bolts of Uniform Strength- Design of Bolts - Design of studs for cylinder cover-simple problems on design of bolts subjected to external force -Design of Riveted joints -classification- Important terms used in riveted joints-materials for rivets-Failures of riveted joints-Strength and efficiency of riveted joints-Simple problems on Single and Double riveted lap joint -Single and Double riveted Butt joint (with single and double strap)

UNIT III: DESIGN OF SHAFTS, KEYS   10Hrs

Types of Shafts- Shaft materials-Standard Sizes- Design of Shafts (Hollow and Solid) using strength and rigidity criteria-design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley.
Keys-Types-Design of Sunk Keys, Effect of Keyways on strength of shaft-Simple problems (excluding keyways).

UNIT IV: DESIGN OF SIMPLE MACHINE PARTS   14Hrs

Design of Couplings – Solid Muff Coupling- Flange coupling (Protected and Unprotected type) - Cotter Joint - Knuckle Joint

UNIT V: DESIGN OF SPRINGS   08Hrs

Spring – terminology, materials and specifications-Classification and Applications of Springs- Stresses in springs, Wahl's correction factor, Deflection of springs-Design of Helical compression springs subjected to uniform applied loads like I.C. engine valves, weighing balance, railway buffers and governor springs-Problems on helical compression springs only- Leaf springs – Construction and application

UNIT VI: ERGONOMICS & AESTHETIC CONSIDERATION IN DESIGN   4Hrs

Ergonomics of Design-Man-Machine relationship-Equipments for control-Ergonomics considerations in design of controls-Equipments for display-Ergonomics considerations in design of display.-Aesthetic considerations regarding shape, size, color (Morgan's code).

REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	A Text book of Machine Design	R.S. Khurmi & J.K.Gupta	S. Chand publication
2.	Machine design	S G Kulkarni	McGraw Hill Education Publications
3	Introduction to Machine design	V B Bhandari	McGraw Hill Education Publications
4.	Design Of Machine Elements Vol I, Vol II	J.B.K. Das , P.L. Srinivas Murthy	Sapna Publication
5	Machine Component Design	William Orthwein	Jaico publication
6	Design Data Hand Book for Mechanical Engineers	K Mahadevan & K Balaveera Reddy	CBS publications

LIST SOFTWARES/WEBSITES

1. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_home.html
2 http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_mod4.html

3. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_mod7.html .
4. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_mod4.html
5. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_mod5.html
6. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/left_mod8.html

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	INTRODUCTION TO DESIGN	Lectures, Discussions ,cooperative learning group based learning, Think-Pair-share activities among group of students
2	DESIGN OF FASTENERS	Lectures, discussions, cooperative learning group based learning, Think-Pair-share activities among group of students
3	DESIGN OF SHAFTS, KEYS	Lectures, cooperative learning group based learning, Think-Pair-share activities among group of students
4	DESIGN OF SIMPLE MACHINE PARTS	Lectures, cooperative learning group based learning, Think-Pair-share activities among group of students Industrial visits, movies.
5	DESIGN OF SPRINGS	Lectures, cooperative learning group based learning, Think-Pair-share activities among group of students Industrial visits, movies
6	ERGONOMICS & AESTHETIC CONSIDERATION IN DESIGN	Discussions, real life industries situation, industrial visits

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	The students should identify at least five applications .He should select the materials for identified applications by using design data hand book. List the mechanical properties of material selected.
2	Observe the system where transmission of power takes place through shaft, Keys, coupling, pulley and belt drive. Get the required information regarding power transmitted (power output by motoror engine etc.). By selecting suitable materials, design the shaft, key and coupling.
3	Assignments on design of Helical Springs, Screwed joints, Riveted joints [one each] with free hand sketches.
4	The student should Download and present various presentations related to design of machine elements
5	The student should Download and present various presentations related to stresses in machine elements.

6	The student should Download and present various presentations related to failure of machine elements.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student Activities	05	Activity sheets	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

Directorate Of Technical Education   Karnataka State   15ME53T   MECH

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
4. Blue books (20 marks)
5. Student suggested activities report for 5 marks
6. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	VSEM	**MACHINE DESIGN**	20
	Year: 2016-17	Course code:15ME53T	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Define factor of safety. List and explain the factors to be considered while selecting Factor of safety. **OR** Explain stress strain diagram of mild steel is differing from that of cast iron with necessary sketches.	10	R/U	1	2
2	A steam engine cylinder has an effective diameter of 350 mm and the maximum steam pressure acting on the cylinder cover is 1.25 N/mm2. Calculate the number and size of studs required to fix the cylinder cover, assuming the permissible stress in the studs as 33 MPa. **OR** The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.	10	A	2	1,2

V- Semester Diploma Examination	
MACHINE DESIGN	
Time: **3 Hours**] **Note: Answer all questions** [Max Marks**: 100**	

	PART-A	
1	List the general Considerations in machine design	5
2	Explain man-machine joint system	5
3	List with examples five basic forms for shape of product	5
	PART-B	
4- a	List the different types of riveted joints and rivets.	5
B	Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter; rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively.	15
	OR	
4- a	Discuss the stresses induced in the Screw fasteners when it is subjected to static loading.	5
b	The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.	15
5- a	Explain the effect of keyway cut into the shaft.	5
b	Select the diameter of a solid steel shaft to transmit 20kw at 200 rpm. The ultimate shear stress for the steel may be taken as 360mpa and factor of safety as 8. If a hallow shaft is to be used in place of solid shaft , finds the inside and outside diameter when the ratio of inside to outside is 0.5.	15
	OR	
5- a	Explain how the shafts are designed when it is subjected to twisting moment only on stiffness/strength basis.	5
b	Select the diameter of a solid steel shaft for a pair of wheels of a railway wagon carries a load of 50KN on each axle box acting at a distance of 100mm outside the wheel base. The gauge of the rails is 1.4 m ,if the stress is not to exceed 100Mpa.	15
6- a	Explain the applications of spring	5
b	Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm2. Neglect the effect of stress concentration.	15
	OR	
6- a	Classify the springs.	5
	Design the spring for the buffers of a rail wagon of mass 20 tonnes is	8

b	moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa.		15
	PART C		
7	Design a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing.		25
8	**OR** Design a rigid flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below: Shear stress on shaft =100 MPa Bearing or crushing stress on shaft =250 MPa Shear stress on keys =100 MPa Bearing stress on keys =250 MPa Shearing stress on cast iron =200 MPa Shear stress on bolts =100 MPa		25

MODEL QUESTION BANK

V- Semester Diploma Examination

MACHINE DESIGN

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO-1: **Understand the concept of design and behaviour of material under varying load conditions, Use of design data books while designing machine components**

Remember

1) Define machine Design.

2) List out the classification of machine design.

3) List general considerations in machine design.

4) Define the following terms a) Load b) Stress c) strain

6) Define factor of safety.

7) Recall the equation for bending.

8) Recall the equation for Torsion.

9) List the various factors to be considered in deciding the factor of safety.

10) Label the salient features of stress- strain diagram for mild steel.

11) List the different types of failure theories.

CO-2: **Design of bolts, nuts, and riveted joints subjected to direct stresses and analyze the type of stresses induced under different load conditions**

Remember

1. Define fastener.

2. Define Riveted joint.

3. List the different types of riveted joints and rivets.

4. Define efficiency of riveted joint.

Understanding

1. Classify the fasteners.

2. Compare Bolt, stud and Nut.

3. Explain bolt of uniform strength. Where it is preferably used.

4. Explain the stresses induced in the Screw fasteners when it is subjected to static loading.

5. Interpret the reasons for "Initial tightening of bolts is essential".

6. Interpret the reasons for "Excessive tightening of bolts is avoided".

7. Explain the necessity of riveted joint.

8. List the applications of riveted joint in modern equipments.
9. Explain the types of failures in riveted joint with sketch.

a. Problems on bolts

Analysis/Application

1. A steam engine cylinder has an effective diameter of 350 mm and the maximum steam pressure acting on the cylinder cover is 1.25 N/mm2. Calculate the number and size of studs required to fix the cylinder cover, assuming the permissible stress in the studs as 33 MPa.

2. A mild steel cover plate is to be designed for an inspection hole in the shell of a pressure vessel. The hole is 120 mm in diameter and the pressure inside the vessel is 6 N/mm2. Design the cover plate along with the bolts. Assume allowable tensile stress for mild steel as 60 MPa and for bolt material as 40 MPa.

3. The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.

4. An eye bolt is to be used for lifting a load of 60 kN. Find the nominal diameter of the bolt, if the tensile stress is not to exceed 100 MPa. Assume coarse threads.

5. Determine the safe tensile load for bolts of M 20 and M 36. Assume that the bolts are not initially stressed and take the safe tensile stress as 200 MPa.

6. An eye bolt carries a tensile load of 20 kN. Find the size of the bolt, if the tensile stress is not to exceed 100 MPa..

7. An engine cylinder is 300 mm in diameter and the steam pressure is 0.7 N/mm2. If the cylinder head is held by 12 studs, find the size. Assume safe tensile stress as 28 MPa.

B. Problems on rivets

Applications/evaluating/creating

1. A double riveted lap joint with zig-zag riveting is to be designed for 13 mm thick plates. Assume σt = 80 MPa ; τ = 60 MPa ; and σc = 120 MPa. State how the joint will fail and find the efficiency of the joint.

2. Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter; rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively.

3. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 56 MPa.

4. A single riveted lap joint is made in 15 mm thick plates with 20 mm diameter rivets. Determine the strength of the joint, if the pitch of rivets is 60 mm. Take σt = 120 MPa; τ = 90 MPa and σc = 160 MPa.

5. Two plates 16 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 90mm. The rivets are 25 mm in diameter. The permissible stresses are as +follows: σt = 140 MPa ; τ = 110 MPa and σc = 240 MPa Find the efficiency of the joint.

6. A single riveted double cover butt joint is made in 10 mm thick plates with 20 mm diameter rivets
with a pitch of 60 mm. Calculate the efficiency of the joint, if σt = 100 MPa ; τ = 80 MPa and σc = 160 MPa.

7. A double riveted double cover butt joint is made in 12 mm thick plates with 18 mm diameter rivets. Find the efficiency of the joint for a pitch of 80 mm, if σt = 115 MPa ; τ = 80 MPa and σc = 160 MPa.

CO-3: Design of machine elements subjected to direct and twisting moments and analyzes the type of stresses induced under different load conditions

Understand

1) Explain the effect of keyway cut into the shaft.
2) List the reasons for rectangular keys are preferred over square keys.
3) Explain how the shafts are designed when it is subjected to twisting moment only on stiffness/strength basis.
4) Explain how the shafts are designed when it is subjected to Bending moment only on stiffness/strength basis.
5) Explain how the shafts are designed when it is subjected to combined twisting moment and bending moment on stiffness/strength basis.
6) List the properties of materials used for shafts.
7) Classify Sunk keys.
8) List he standard sizes of Transmission shafts.
9) Explain how the shafts are designed on Rigidity basis.

Problems on shafts

Applications

1) Select the diameter of the shaft for a mild steel rotating at 200 rpm, transmiting 20kW with a allowable shear stress of 42MPa.

2) Select the diameter of the shaft for a mild steel rotating at 240rpm, is transmitting 1 MW The maximum torque transmitted exceeds the mean torque by 20%. The allowable shear stress as 60mpa.

3) Select the diameter of a solid steel shaft to transmit 20kw at 200 rpm. The ultimate shear stress for the steel may be taken as 360mpa and factor of safety as 8. If a hallow shaft is to be used in place of solid shaft , finds the inside and outside diameter when the ratio of inside to outside is 0.5.

4) Select the diameter of a solid steel shaft for a pair of wheels of a railway wagon carries a load of 50KN on each axle box acting at a distance of 100mm outside the wheel base. The gauge of the rails is 1.4 m ,if the stress is not to exceed 100Mpa.

5) Select the diameter of a solid steel shaft is subjected to bending moment of 3000N-m and a torque of 10000N-m. The shaft is made of 45 c 8 steel having ultimate tensile stress of 700Mpa and Ultimate shear stress of 500Mpa. Assuming factor of safety as 6.

6) Select the diameter of a solid steel shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 metres. It carries two pulleys each weighing 1500 N supported at a distance of 1 metre from the ends respectively. Assuming the safe value of stresses

7) Select the diameter of a solid steel shaft by considering two different theories of failure made of steel of yield strength 700 MPa is subjected to static loads consisting of a bending moment of 10 kN-m and a torsional moment of 30 kN-m. and assuming a factor of safety of 2.

8) Choose the outside and inside diameter of a hollow steel shaft transmits 600 kW at 500 r.p.m. The maximum shear stress is 62.4 MPa. The outer diameter is twice of inside diameter, assuming that the maximum torque is 20% greater than the mean torque.

Problems on keys

Application/Evaluation

1) Recommend the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa.

2) Recommend the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2 for a 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 MPa is to be used.

3) A 15 kW, 960 r.p.m. motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stresses for the mild steel key are 56 MPa and 112 MPa. Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft.

4) Select the length of a 20 mm wide key required to mount a pulley on the shaft so that the stress in the key does not exceed 42MPa. A shaft 80 mm diameter transmits power at maximum shear stress of 63 MPa.

5) Select the dimensions of the key so that A shaft 30 mm diameter is transmitting power at a maximum shear stress of 80 MPa. If a pulley is connected to the shaft by means of a key, the stress in the key is not to exceed 50 MPa and length of the key is 4 times the width.

6) Select a suitable key for the gear having a steel shaft has a diameter of 25 mm. The shaft rotates at a speed of 600 r.p.m. and transmits 30 kW through a gear. The tensile and yield strength of the material of shaft are 650 MPa and 353 MPa respectively. Take a factor of safety 3. Assume that the key and shaft are made of the same material.

CO-4: Design of machine element like Solid Muff Coupling- flange coupling subjected to direct and twisting moments and Knuckle joint-Cotter joint subjected to direct stress and analyze the various modes of failure(with numeric examples)

Apply/ Analysis

Muff coupling

1) Design a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.

2) Design a muff coupling to connect two shafts transmitting 40 kW at 120 r.p.m. The permissible shear and crushing stress for the shaft and key material (mild steel) are 30 MPa and 80 MPa respectively. The material of muff is cast iron with permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is 25 per cent greater than the mean torque.

Problems on flange coupling

Apply/ Analysis

1) Design a cast iron protective type flange coupling to transmit 15 kW at 900
r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The
Following permissible stresses may be used :
Shear stress for shaft, bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa
2) Design a protective type of cast iron flange coupling for a steel shaft
transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa.

3) Design a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 r.p.m. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa.

4) Design a rigid flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. The permissible stresses are given below:

Shear stress on shaft =100 MPa
Bearing or crushing stress on shaft =250 MPa
Shear stress on keys =100 MPa
Bearing stress on keys =250 MPa
Shearing stress on cast iron =200 MPa
Shear stress on bolts =100 MPa

5) Two 35 mm shafts are connected by a flanged coupling. The flanges are fitted with 6 bolts on 125 mm bolt circle. The shafts transmit a torque of 800 N-m at 350 r.p.m. For the safe stresses mentioned below, calculate 1. diameter of bolts ; 2. thickness of flanges ; 3. key dimensions ;4. hub length; and 5. power transmitted.
Safe shear stress for shaft material = 63 MPa
Safe stress for bolt material = 56 MPa
Safe stress for cast iron coupling = 10 MPa
Safe stress for key material = 46 MPa

Problems on cotter joint

Apply/ Analysis

1. Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension; 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed.

2.Two rod ends of a pump are joined by means of a cotter and spigot and socket at the ends. Design the joint for an axial load of 100 kN which alternately changes from tensile to compressive. The allowable stresses for the material used are 50 MPa in tension, 40 MPa in shear and 100 MPa in crushing.

3. Two mild steel rods 40 mm diameter are to be connected by a cotter joint. The thickness of the cotter is 12 mm. Calculate the dimensions of the joint, if the maximum permissible stresses are: 46 MPa in tension ; 35 MPa in shear and 70 MPa in crushing.

4. Design a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress 50 MPa ; shear stress 35 MPa and crushing stress= 90 MPa.

Problems on Knuckle Joint

Apply/ Analysis

1. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.

2. Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.

3. Design a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing.

4. A knuckle joint is required to withstand a tensile load of 25 kN. Design the joint if the permissible stresses are :σt = 56 MPa ; τ = 40 MPa and σc = 70 MPa.

CO-5: Design procedure of machine elements subjected to twisting moment and analyzes the type of stresses induced in them

Remember
 1) List the applications of spring
3) List materials used in Springs.
4) Define the terms used in springs.
5) Name the springs used in a) Spring balance b)Ball Pen c) Door Hinges d) Truck Chassis e)Clock

Understand
1) Classify the springs.
2) Explain the significance of Whal's factor
3) Expline the applications of spring
 4) List the   materials used in Springs.

Problems on springs

Apply/ Analysis

1) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm2. Neglect the effect of stress concentration.

2) Design and draw a valve spring of a petrol engine for the following operating conditions:
Spring load when the valve is open = 400 N
Spring load when the valve is closed = 250 N
Maximum inside diameter of spring = 25 mm
Length of the spring when the valve is open= 40 mm
Length of the spring when the valve is closed= 50 mm
Maximum permissible shear stress = 400 MPa

3) Design the spring for the buffers of a rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The

maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa.

4) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm2,with considering whal's factor.

CO-6: Know the Principles of design as per ergonomic, and Environmental considerations

Remember

1) Define Ergonomics.
2) List with examples five basic forms for the shape of Product.
3) List the types of controls.
4) List the types of Display.

Understand

1) Explain the relationship between functional requirement and external appearance of the Product.
2) Explain the scope of ergonomics in product design.
3) Explain the meaning of different colors as per morgan's code.
4) Explain man – machine joint system.
5) Explain the ergonomics considerations in design of controls.
6) Explain the ergonomics considerations in design of Display.

	Course Title: **MECHATRONICS**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME54T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit **:04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites: Knowledge of Basic Science, Mathematics, Basic Electrical and Electronics Engineering and Mechanical Engineering discipline courses

Course Objectives.

To expose the students in the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems

Course out comes

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Discuss the importance of mechatronics systems and know the usage of Sensors and Transducers for automation applications	*R/U/A*	2	07
CO2	Acquire the knowledge of combinational and sequential logic circuits	*R/U/A*	2	11
CO3	Know the various electro and mechanical systems available for automation	*R/U/A*	2	06
CO4	Design the Building blocks of Mechanical, Electrical, Fluid and Thermal Systems	*R/U/A*	2	10
C05	Describe the significance of PLC for automation	*R/U/A*	2	11
C06	Know the importance of communication systems and its interface and Design the Mechatronics Systems.	*R/U/A*	2	07
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHATRONICS	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks weightage	weightage (%)
			R	U	A		
1	MECHATRONICS, SENSORS AND TRANSDUCERS	07	05	05	20	30	20.6
2	DIGITAL LOGIC AND DATA PRESENTATION	11	05	05	20	30	20.6
3	ACTUATION SYSTEMS	06	05	05	20	30	20.6
4	SYSTEM MODELS AND CONTROLLERS	10	05	05	20	30	20.6
5	PROGRAMMABLE LOGIC CONTROLLERS	11	-	05	10	15	10.8
6	COMMUNICATION AND DESIGN OF MECHATRONICS SYSTEM	07	-	-	10	10	6.8
	Total	**52**	**20**	**25**	**100**	**145**	**100**

Legend: R; Remember, U: Understand A: Application

UNIT I: MECHATRONICS, SENSORS AND TRANSDUCERS   07 Hrs

Introduction to Mechatronics Systems - Measurement Systems - Control Systems -Sensors and Transducers - Performance Terminology - Sensors for-Displacement, Velocity, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors, Selection of Sensors.

UNIT II: DIGITAL LOGIC AND DATA PRESENTATION   11Hrs

Digital signals-Introduction,-BCD system-Analog and digital signals- Digital to analog conversion.-Logic Gates-,AND-OR-NOT-NAND-NOR-XOR,Applications-Coder-Encoder-Decoder with seven segment display -LCD-(Traffic Light)-Sequential logic-,Flip Flops,-SR, JK, DFlip flops,-Registers- Data presentation system,-Display-Data presentation elements-Types-Printers- Dotmatrix, Laser printer, Data acquisition system, Selection criteria.

UNT III: ACTUATION SYSTEMS   06Hrs

Electrical Actuation Systems - Mechanical Switches - Solid State Switches-Types –Diode-
Power MOSFETs - Solenoids - D.C Motors-Basic working principle-Types- A.C Motors-
Basic working principle-Types - Stepper Motors- Basic working principle - List Types -
Stepper motor specifications
Mechanical Actuation Systems - Ratchet and Pawl - Bearings.

UNIT IV: SYSTEM MODELS AND CONTROLLERS   10Hrs

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems,-Rotational -
Translational Systems,-Electromechanical Systems - Hydraulic - Mechanical Systems-
Continuous and discrete process Controllers - Control Mode - Digital Controllers - Velocity
Control - Adaptive Control.

UNIT V: PROGRAMMABLE LOGIC CONTROLLERS   11Hrs

Introduction to Memories – RAM, ROM, PROM, EPROM, EEPROM, Microprocessor-
block diagram-Architecture of 8051, microcontroller- Architecture, pin configuration of Intel
8081, difference between microprocessor and microcontroller. Programmable Logic
Controllers - Basic Structure - Input / Output Processing – Programming - ladder diagram -
Mnemonics - Timers, Internal relays and counters - Shift Registers - Master and Jump
Controls - Data Handling - Analogs Input / Output – Selection of PLC

UNIT VI: COMMUNICATION & DESIGN OF MECHATRONICS SYSTEM   07Hrs

Digital Communication Systems-Centralized, Hierarchical and Distributed Control-
Networks-Protocols-Open Systems Interconnection communication model-Communication
Interfaces-Possible Design Solutions Case Studies of Mechatronics Systems,-Car Park barrier
Systems - Engine Management Systems- Hard disc drive.

TEXT BOOKS AND REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Mechatronics”	W.Bolton	Pearson education
2.	Mechatronics-Principles, Concepts and Applications	Nitaigour Premch and Mahalik	Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2006
3	Mechatronics	HMT	Tata McGraw Hill Publishers, New Delhi
4.	Programmable logic controllers	W.Bolton	Pearson education
5	Digital electronics	Flyod	-
6	Exploring PLC with applications	Pradeep Kumar Srivatsava	-

LIST OF SOFTWARE/LEARNING WEBSITES

     1. http://www.vlab.com

2. http://www.mtabindia.com
3. http://www.nptel.ac.in

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	MECHATRONICS, SENSORS AND TRANSDUCERS	Lecturer, Demonstration, Video, Presentation
2	DIGITAL LOGIC AND DATA PRESENTATOIN	Lecturer, Demonstration, Video, Presentation
3	ACTUATION SYSTEMS	Discussions, real life industries situation, industrial visits. Expose to various actuation systems
4	SYSTEM MODELS AND CONTROLLERS	Teaching, Presentations, Industrial visits, movies.
5	PROGRAMMING LOGIC CONTROLLERS	Demonstration, Video, Presentation, Industrial Visit, Mini Project
6	COMMUNICATION AND DESIGN OF MECHATRONICS SYSTEM	Discussions, real life industries situation, industrial visits

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Each group of students Build and operate simple circuit using application of sensor and submit an hand written report
2	Conduct study on real time applications of different type of Sensors-each one from force & torque type, velocity and acceleration type, proximity type, position type and vision type. And submit a hand report on study
3	Each student will give an activity to Prepare simple circuit diagram for given conditions using logic gates.
4	Development of ladder diagram, programming using PLC for a) measurement of speed of a motor b) motor start and stop by using two different sensors c) simulation of a pedestrian traffic controller d) simulation of four road junction traffic controller e) lift / elevator control f) washing machine control g) tank level control h) soft drink vending machine control
6	Take case study on applications of mechatronics systems in nearby industry; submit report on same

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Report/Log of activity	
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*
1. Blue books(20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	VSEM	**MECHATRONICS**	20
	Year: 2016-17	Course code:15ME54T	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Classify the sensors and transducers	5	U	1	2
2	Define the terms: range and span, repeatability, stability, resolution, output impedance OR List the factors for selection of sensors	5	R	1	2
3	Build Decoder with seven segment display	5	A	2	2
4	Make use of sketch explain weighted-resistor DAC OR Make use of sketch explain successive approximation ADC.	5	A	2	2

Diploma in Mechanical Engineering
V- Semester
MECHATRONICS

Note; Answer 6 questions from part A & Any 7 from Part B

PART-A   6x5=30

1. Explain with a line diagram the function of each element of a measurement system
2. Why T-Flip-Flops are most commonly used in counters?
3. List different data presentation elements
4. Explain Hydrostatic, solid film and boundary layer bearing.
5. Explain briefly Adaptive Control and its three stages of operations.
6. Explain briefly protocols and its elements.
7. List the selection factors of PLC.
8. Explain briefly protocols and its elements.
9. What are the Specifications of stepper motor?
10. List the performance features of sensors and transducers

PART-B   7x10=70

1. Make use of a sketch to explain the working of a diaphragm pressure gauge.
2. Make use of a sketch to explain coded digital signal to a set of Traffic Lights
3. Make use of a sketch to explain the working of Laser printer.
4. Make use of a sketch to explain Zener diode protection circuit
5. Make use of a sketch to explain Digital closed-loop Control system.
6. Make use of a sketch to explain model of building up a thermal system.
7. Make use of a sketch to explain rotary potentiometer.
8. Build a ladder programming and list its sequences with line diagram
9. Explain Continuous and discrete process Control processes.
10. Make use of a sketch to explain design of Car Park barrier System.
11. Explain briefly
    a. Centralized computer control
    b. Hierarchical system
    c. Distributed system

Diploma in Mechanical Engineering
V Semester
Course Title: MECHATRONICS

CO I. Discuss the importance of mechatronics systems and know the usage of Sensors and Transducers for automation applications

REMEMBER QUESTIONS

1) Define Mechatronics?
2) Define system with example.
3) Define sensors and transducers with an example.
4) List the factors for selection of sensors.
5) Define the terms: range and span, error, accuracy, sensitivity, hysteresis error, non-linearity error, repeatability/reproducibility, stability, dead band/time, resolution, output impedance.
6) List the performance features of sensors and transducers.

UNDERSTANDING QUESTIONS

1) Explain the importance of mechatronics.
2) Explain with a block diagram the measurement system.
3) Explain control systems and their types.
4) Classify the sensors and transducers.
5) Explain sensors for displacement, position and proximity.
6) Explain the working of light sensors.

APPLICATION QUESTIONS

1) Make use of a sketch to explain the working of pneumatic sensors.
2) Build a line diagram and explain the function of each element of a measurement system.
3) Make use of a sketch to explain the working of proximity switches.
4) Make use of a sketch to explain the working of optical encoder.
5) Make use of a sketch to explain the Hall Effect sensors.
6) Make use of a sketch to explain the working of tachogenerator.
7) Make use of a sketch to explain sketch bimetallic strip/thermostat.
8) Make use of a sketch to explain the working of a diaphragm pressure gauge.
9) Make use of a sketch to explain strain gauge load cell.
10) Make use of a sketch to explain piezoelectric sensor.
11) Make use of a sketch to explain turbine meter.
12) Make use of a sketch to explain float type liquid level meter.
13) Make use of a sketch to explain the working of LVDT.
14) Make use of a sketch to explain the bimetallic strips.

CO 2: Acquire the knowledge of combinational and sequential logic circuits

LEVEL: REMEMBER

1) Define analog signal.
2) What are Digital signals?
3) List different data presentation elements.
4) List different printers.
5) List the selection of DAQ criteria.
6) List the Applications of logic gates.

LEVEL: UNDERSTANDING

1) Explain briefly BCD system.
2) Explain briefly various data presentation elements.
3) Explain briefly data acquisition system.
4) Explain display.

LEVEL: APPLICATION

1. Make use of a sketch to explain briefly weighted-resistor DAC
2. Make use of a sketch to explain the successive approximation ADC.
3. Construct the truth table for the following logic gates
   a. AND gate
   b. OR gate
   c. NOT gate
   d. NOR gate.
   e. NAND gate
   f. XOR gate.
4) Make use of a sketch to explain coded digital signal to a set of Traffic Lights.
5) Make use of a sketch to explain sequential logic system.
6) Make use of a sketch to explain following Flipflops.
   a. Flip Flops.
   b. SR.
   c. JK.
   d. D Flip Flops.
   e. Registers.
7) Make use of a sketch to explain dot matrix print head mechanism.
8) Make use of a sketch to explain basic elements of a laser printer.
9) Make use of a sketch to explain Decoder with seven segment display.
10) Make use of a sketch to explain LCD.

C0 03: Know various actuation systems and understand the working of mechanical, electrical, hydraulic actuation systems.

LEVEL: REMEMBER

1) Define a bearing.

2) List the uses of bearings.
3) List all types of bearings.
4) List different types of solid state switches.
5) List Different types of DC motors.
6) List Different types of AC motors.
7) Define stepper motor.
8) List different types of stepper motors.
9) List the terms commonly used for specifying stepper motors.

LEVEL: UNDERSTANDING

1) Explain Hydrostatic, solid film and boundary layer bearing.
2) Explain in brief electrical systems.
3) Explain the terms commonly used for specifying stepper motors.

LEVEL: APPLICATION

1) Make use of a sketch to explain simple sensor actuation system.
2) Make use of a sketch to explain principle of the Ratchet and Pawl.
3) Make use of a sketch to explain basic elements of ball and roller bearings.
4) Make use of a sketch to explain plain journal bearing.
5) Make use of a sketch to explain Hydrodynamic bearing.
6) Make use of a sketch to explain relays.
7) Make use of a sketch to explain diodes.
8) Make use of a sketch to explain MOSFETs.
9) Make use of a sketch to explain solenoids.
10) Make use of a sketch to explain the basic working principle of DC motor.
11) Make use of a sketch to explain the basic working principle of AC motor.

CO 04: Design the Building blocks of Mechanical, Electrical, Fluid and Thermal Systems.

LEVEL: REMEMBER

1) List different Control Modes.

LEVEL: UNDERSTANDING

1) Explain briefly the necessity of mathematical models.
2) Explain electrical system building blocks.
3) Explain thermal system building blocks
4) Explain electromechanical system.
5) Explain hydraulic-mechanical system.
6) Explain Continuous and discrete process Control processes.
7) Explain briefly Control Modes.
8) Explain briefly Adaptive Control and its three stages of operations.

1) Make use of a sketch to explain different mechanical building block systems like spring, dashpot and mass.
2) Make use of a line diagram to explain model of building up a spring -dashpot-mass mechanical system.
3) Make use of a line diagram to explain model of building up a resister -inductor-capacitor electrical system.
4) Make use of a sketch to explain model of building up a thermal system.
5) Make use of a sketch to explain the rotational-translational system.
6) Make use of a sketch to explain rotary potentiometer.
7) Make use of a sketch to explain hydraulic system and load (without derivation).
8) Make use of a sketch to explain Digital closed-loop Control system.
9) Make use of a sketch to explain Velocity Control.

CO 05: Describe the significance of PLC for automation

LEVEL: REMEMBER

1. List the different types of memories.
2. Define Microprocessor.
3. Define Microcontroller.
4. Define PLC.
5. List Input/output processing.
6. Define counter.
7. List the use of master relay.
8. List the selection factors of PLC.

LEVEL: UNDERSTANDING

1) Classify Memories.
2) Explain the following :
   a. RAM, b. ROM, c. PROM, d. EPROM, e. EEPROM
3) Explain the architecture of Microprocessor.
4) Explain the architecture of microcontroller.
5) Compare Microprocessor and Microcontroller.
6) Explain with sketch architecture of PLC
7) Explain Input/output processing.
8) Explain ladder programming and its sequences with line diagram.
9) Explain ladder program with ladder diagram.
10) Infer the mnemonics used in PLC.
11) Explain shift registers.
12) Explain briefly data handling.

LEVEL: APPLICATION

1) Construct the ladder diagram for following functions.
   a. Delay-on timer
   b. On-delay timer(TON)
   c. Timing with off-delay(TOFF)
2) Construct a ladder diagram for input/output of counters and various ways of representing the same.

3) Construct a PLC ladder diagram for Master Control Relay.

4) Construct a PLC ladder diagram for Jumps.

CO 06: Know the importance of communication systems and its interface and Design the Mechatronics Systems.

LEVEL: REMEMBER
1) List different types of networks.
2) List different types of network layers.

LEVEL: UNDERSTANDING
1) Explain briefly the role of digital communications.
2) Explain briefly
   a. Centralized computer control
   b. Hierarchical system
   c. Distributed system
3) Explain different types of networks.
4) Explain briefly protocols and its elements.
5) Explain briefly the open system interconnection communication model.
6) Explain briefly different network layers.
7) Explain briefly serial and parallel interfaces.

LEVEL: APPLICATION
1. Make use of a neat sketch to explain Car Park barrier System.
2. Make use of a neat sketch to explain of Engine Management Systems.
3. Make use of a neat sketch to explain design of hard disc drive.

	Course Title: **PROFESSIONAL PRACTICES (Mechanical Stream)**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code:15ME55P
	Type of Course: **Assignment Group talk and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Enthusiasm to Explore New things by taking individual tasks and acquires skills from participating in group activities.

Course Objectives:

Professional development of Diploma engineering students is to be done by exposing them to various simulative situations in the industries. This is achieved by involving students in activities such as inviting experts from various industries for sharing their experiences, arranging industrial visits, seminars etc.

COURSE OUT COME

On successful completion of the course, the students will be able to:

	Course Outcome	CL	Linked activity	Linked PO	Teaching Hrs
CO1	Search the information related to topic, and acquire knowledge of contemporary issues related to advancements in Mechanical engineering.	Analysis	1	2,8,9	15
CO2	Exposure to various industry environment practice and global, societal, economic, and/or environmental issues, by listening experts talks and interact with them	Application/ analysis	2	2,7,8,9	15
CO3	Discuss & disseminate about advancements in related profession including societal, environmental	Innovative /Analysis	3	7,8,9	15
CO4	Develop individual confidence and acquire life skills to handle various engineering assignments	Application	4	2,7,8	15
CO5	Enhancing the employability skills and to increase his ability to engage in, life-long learning, by undergoing industrial visits	Analysis /Creation	5	2,4,10	18
			Total		**78**

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
PROFESSIONAL PRACTICES	0	3	0	1	0	0	2	3	2	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

1. Information Search and Data collection: 15HRS

Information search can be done through manufacturer's catalogue, websites, magazines; books etc. *Following topics are suggested.*

1. Engine lubricants & additives
2. Automotive gaskets and sealants
3. Automobile automatic diagnostics
4. Engine coolants and additives
5. Two and Four wheeler carburettor.
6. Power steering
7. Filters
8. Different drives/Transmission systems in two wheelers.
9. Types of bearings – applications and suppliers.
10. Heat Exchangers
11. Maintenance procedure for solar equipment.
12. Tools holder on general purpose machines and drilling machines.
13. The student should search any relevant information of innovation principles should lead to selection of Project in Current semester.
14. Cutting tools
15. Additive manufacturing
16. Alternative materials for manufacturing
17. Composite materials
18. Nano materials
19. Welding in medical applications
20. Micro machining and fabrication
21. Advanced metal casting
22. Special purpose machines
23. Jigs and fixtures
24. Plant maintenance
25. Industrial safety
26. Fire fighting
27. Industrial Effluent treatment
28. Low cost automation

Method for conducting Graded activities

1. The student should individually select the topic, and search the information related to topic.
2. The report is strictly hand written document to have knowledge of precise writing and report making based on data collection

3. Carry out class room presentation.

Experts / Professionals from different field/industries are invited to deliver lectures at least TWO sessions in a semester. The topics may be selected by the teacher /industry expert to develop required skills.

Note: The ISTE student chapter/CCTEK/ Institute of engineers (Institute chapter)/ student clubs of polytechnic may be used as platform to conduct this activity.

1. Pollution control.
2. Non destructive testing.
3. Fire Fighting / Safety Precautions and First aids.
4. Computer Networking and Security.
5. Career opportunities,
6. Yoga Meditation,
7. Aids awareness and health awareness.
8. Use of plastics in automobiles.
9. Nonferrous Metals and alloys for engineering applications
10. Surface Treatment Processes like electroplating, powder coating etc.
11. Computer aided drafting.
12. Industrial hygiene.
13. Composite Materials.
14. Heat treatment processes.
15. Ceramics
16. Safety Engineering and Waste elimination
17. Interview Techniques.
18. Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen
19. Piping technology
20. Electronic fuel injection systems
21. Exhaust gas analysis.
22. Vehicle testing.
23. Environmental pollution & control.
24. Vehicle aerodynamics & design.
25. Earth moving machines.
26. Biotechnology
27. Nanotechnology
28. Rapid prototyping
29. Programmable logic controllers
30. TQM
31. MPFI
32. Hybrid motor vehicles
33. Packaging technology
34. Cloud computing
35. Expert systems

Method for conducting Guest lectures
1. The teacher/ISTE student chapter convener should fix up the date for guest lecture
2. The HOD of the department should chair the event
3. The students of class allowed to participate in the session

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4. Watch the talk and make the brief hand written report on the guest lecture delivered by each student as a part of Term work.
5. Make Audio/visual record of the guest lecture by using any smart devices
6. Opportunity should be provided for students for live Interaction with experts and record it on any one smart device.

3. Group Discussion: (One topic) 15HRS

The students shall discuss in group of six students .Some of the suggested topics are
1. Polythene bags must be banned!
2. Do we really need smart cities?
3. E – Books or Printed books – what's your choice?
4. Is Face book for the attention – seeking and lazy people?
5. Globalization and its impact on Indian Culture.
6. Analytically evaluate the solutions to traffic problems
7. Global warming is caused more by developed countries
8. Rain forests help in maintaining the earth's ecosystem
9. Reservation for women would help the society
10. How to deal with terrorism
11. Water resources should be nationalized
12. Daughters are more caring than sons
13. NGOs - Do they serve people's interests?
14. Managers are born, not trained
15. Managerial skills learnt in the classroom
16. Women are good managers
17. India's growth rate is bridging gap between rich and poor.
18. Nuclear power is a safe source of energy
19. Electronic media vs. print media
20. Corruption is the price we pay for democracy
21. Multinational corporations: Are they devils in disguise?
22. Advertising is a waste of resources.
23. Privatization will lead to less corruption.
24. China market - a threat to Indian market
25. Technology Creates Income Disparities
26. India should be reorganized into smaller states.
27. Rising petrol prices - Govt. can control?
28. Smaller businesses and start-ups have more scope
29. Developing countries need trade, not aid.
30. Business and Ethics do not go together
31. Performance based bonuses for government employees should be welcomed
32. Depreciation of Indian Rupee has only negative impact on the economy
33. Gold: Best investment or a bursting bubble?
34. Freedom of press should exist
35. India needs a strong dictator
36. Media is a mixed blessing/How ethical is media?
37. Computer viruses are good
38. India should practice "Swadeshi"
39. The government should stop funding IIT's and IIM's
40. Food Bill - Is it really something India needs?
41. Will India really be the superpower of 21st century?

42. Quality is a myth in India.
43. China - A threat to India?
44. Indian villages - our strength or our weakness?
45. Mobile phones - requirement of the day.
46. Cursing the weather is bad farming
47. If you want peace, prepare for war
48. Education is a progressive way of discovering your ignorance.
49. Beauty contests degrade womanhood
50. If you are not a part of the solution, you are part of the problem
51. Examinations - has it killed education?
52. The medium of teaching in schools should be English
53. A room without books is like a body without soul.
54. Educated Indians lack national commitment.
55. E-Learning is good for the education system and society

Methodology for conducting Group discussion/Seminar
1. The teacher will allot a topic for a group of six students
2. The teacher should give an introductory talk on Ways and rules to carry out group discussion
3. The students should ask to show interest with others and work effectively with them to meet common objective. The teacher should provide tips to accept feedback in a constructive and considerate way and how to handle frustrations in group, while discussion.
4. The placement officer and any other senior faculty of the institute/ HOD of other department should be invited and they should act as observing members, apart from teacher
5. The teacher should fix up the time duration for initiating and conducting the activity

6. **Documentation to be produced for validation**
   - Hand written document on minutes of discussion, description of the topic discussed
   - Record the few minutes of discussion by smart device

4. Individual Assignments and Life skills   15HRS

The students will perform ANY ONE of the following activities individually (other similar activities may be considered) in both the sections
A. Individual assignments
1. Collecting Failure data for automobile / machines / equipment.
2. Study of Hydraulic system for any one application like – dumpers, Earth moving equipment, Auto service station.
3. Survey of oils used for hydraulic circuits – specifications, properties, costs, manufacturers names etc.
4. Study any one type of CNC machining centre and prepare report on tooling and tool holding devices
5. For a given job write a sequence of operations performed by automated manufacturing system. Draw a block diagram of control system to perform above operations
6. Survey of types of bearings involving information about construction working principles, mounting, lubrication, materials, advantages, limitations and cost.

7. Prepare a trouble shooting chart for any refrigeration system and suggest remedial measures to avoid failures
8. For a drilling or milling operations on a simple machine component,
9. Draw a jig or fixtures showing various features like locating clamping, fool proofing etc.
10. Compare non traditional methods on the basis of working principles, accuracy , MRR, Applications and limitations a) EBM b) PAM C)AJM d)WJM

B. Life skills
1. Conduct aptitude, general knowledge test, IQ test, Solve Puzzles.
2. Set the goal for personal development.
3. Develop good habits to overcome stress.

Methodology for conducting activity

1. The teacher will assign a topic for individual student; give sufficient time to complete the task. Ask the student to submit an hand written report
2. The teacher should conduct any one specified life skill activity with local NGO/ placement cell/ISTE student chapter/CCTEK/ NSS unit of the institute. The student should present his/her experiences in a class and make report.

5. Industrial Visits   18HRS

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. Following are the suggested types of Industries/ Fields.
Note: One Industrial visit is arranged per practical batch of students.

1. Automobile manufacturing / press component / auto component manufacturing units to observe the working of SPM / Non Conventional Manufacturing process / CNC / FMS / Robots
2. Refrigeration and air conditioning manufacturing / servicing units
3. Industries
4. State transport depot/workshops
5. Automobile service stations for four wheelers/Wheel Balancing unit for light and/or heavy motor vehicles/exhaust gas analysis and vehicle testing / ST workshop.
6. Co-ordinate measuring machine to observe its construction working specifications and applications. Engine Testing unit to gather details regarding the testing procedures/parameters etc.
7. Food processing/ Dal mill/ Oil Mill/ Automated bakery unit.
8. Textile industry / Textile machinery manufacturing / garment manufacturing /embroidery / textile printing and dying units.
9. Hydro electric and Thermal power plants.
10. Tyre retreading, paint manufacturing, foundries, forging unit, heavy fabrication unit, steel and wooden furniture/Toys manufacturing/Agricultural equipment manufacturing units.
11. Hardware and Machinery stores selling agro equipment
12. Plastic injection moulding, extrusion, blows moulding.
13. Stone crushers / hot mix plant/ service stations of JCBs and other earthmoving equipment

M Methodology for conducting activity

1. The subject teacher(s) have liberty to select nearby organization/industry of local vicinity with prior approval of principal of the institute

2. Arrange the nearby visit and Prepare a word processing report of the visit including details observations made, Details of visit should be mentioned with date , place etc

The course will be delivered through discussions and activities

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment meth	CIE	IA	Students	Each activities @5 marks each	25	Report	1,2,3,4,5
				End of the course	50	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Student activities report for25 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

For end examination:

1. **Note for examiners : The records of the activities should be preserved in the department for minimum three years and the examiner should verify these records to prevent duplication of the activity**

Scheme of Valuation for End Examination

Serial no	Description	Marks
1	**Report and presentation on Information Search and Data collection**	10
2	**Document on Guest Lecturer by experts**	10
3	**Recording of Group discussions made by any smart devices**	10
4	**Report on Individual assignment/ Life skill activity recorded**	10
5	**Report on Industrial visit**	10
	TOTAL	**50**

• MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY

Dimension	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Student Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

RUBRICS FOR ACTIVITY(5 Marks)

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity

Time: **3 Hours**]   [Max   Marks**:   50**

1. Write brief note on information searched and data collected activity   10marks

2. Give brief explanation about knowledge acquired by you during

    the guest lecture   10 marks

3. Write the conclusion of the topic given for the group discussion   10 marks

4. Write brief note on individual assignment performed and

    information gathered and data collected activity   10marks

5. Write the sequence of processing followed in the industry/work shop

    You have visited   10 marks

Note: The marks should be awarded on the basis of Reports/Documents submitted by the student

	Course Title: **THERMAL ENGINEERING LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME56P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Learning concepts of Basic and applied Thermal engineering

By undergoing this lab the students will get enough confident about all the types of IC engines parts, so that they can rectify some sort of problems normally occurring in their automobiles.

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked experiments**	**Linked PO**	**Teaching Hrs**
CO1	Appreciate the practical ways to find calorific values of fuel	*U/A*	01	2,3	**06**
CO2	Understand the various components and mechanisms of I. C. Engines. Appreciate the Mechanism of ports /Valves functioning in 2-stroke petrol /Diesel engine	*U/A*	2,3 & 13,14	2,3	**24**
CO3	Evaluating the performance characteristics of single cylinder petrol engine at different loads and single cylinder diesel engine at different loads and draw the heat balance sheet	*U/A*	4,5,6,7	2,3	**24**
CO4	Understand the method of finding the indicated power of individual cylinders of an engine by using morse test	*U/A*	8	2,3	**06**
C05	Understand the method of evaluating the co efficient of performance of refrigerator	*U/A*	9	2,3	**06**
CO6	Understand the method of finding the thermal conductivity of material	*U/A*	10,11,12	2,3	**12**
		Total sessions			**78**

Legend   U; Understand A; Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
THERMAL ENGINEERING LAB	**0**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
PART A. PERFORMING EXPERIMENTS		
1	Determination of calorific value of liquid and gaseous fuel by using Bomb calorimeter /Boy's gas calorimeter	06
2	Draw the valve timing diagram of 4-stroke diesel engine	06
3	Plot the performance characteristics of single cylinder diesel engine for different loads	06
4	Draw the heat balance sheet of single cylinder diesel engine	06
5	Plot the performance characteristics of single cylinder petrol engine for different loads	06
6	Find the indicated power of individual cylinders of an engine by using MORSE test	06
7	Determine the volumetric efficiency of air compressor	06
8	Determine the co efficient of performance of refrigerator	06
9	Determine thermal conductivity of thick slab	06
10	Determine thermal conductivity of composite wall	03
11	Determine thermal conductivity of thick cylinder	03
PART- B. STUDY EXPERIMENTS		
13	Study of I.C. Engine parts (Cylinder block, head, piston and piston ring Connecting rod& crank shaft , spark plug, Carburettor, fuel injector and fuel pump	06
14	Study of Differential, rear axle and power steering mechanism	06
15	Case study on Dismantling and assembly of engines	06
	TOTAL	**78**

Elements of Thermal Engineering by R.S.Khurmi/ Rajputh

Automobile Engg by kirpal Singh (Vols. 1 and II)

SUGGESTED STUDENT ACTIVITY

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeation should occur*

1	Collect/ download product catalogues with specification of various types of energy conservation equipment/ devices and heat exchanger of recent trends.
2	Identify and list at least 10 equipments/devices which require heat transfer and prevention of heat transfer. Also state mode of heat transfer and methods used to prevent heat transfer.
3	At least one visit of any power plant/ industry where various items like air compressor, heat exchanger, cooling tower, condenser etc. can be shown to students.

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3,4,5,6
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3,4,5,6
				Activity	05	Report	1,2,3,4,5,6
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3,4,5,6
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.
3. Student suggested activities report for 5 marks
4. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

EQUIPMENT LIST

Serial no	Description	Quantity
1	Bomb calorimeter	1
2	Boys gas calorimeter	1
3	2- Stroke , Single- Cylinder petrol engine test rig	1
4	4 –Stroke , Multi cylinder petrol engine test rig(Morse test)	1
5	4 – Stroke , Single cylinder diesel engine test rig with Exhaust Gas Calorimeter	1
6	2 Stage reciprocating air compressor	1
7	Refrigeration unit	1
8	Thermal Conductivity Apparatus- Thick slab	1
9	Thermal Conductivity Apparatus- Composite wall	1
10	Thermal Conductivity Apparatus- Thick cylinder	1
11	Cut section models – petrol engine and diesel engine	2
12	I.C engine models	1

Scheme of Valuation for End Examination		
Serial no	**Description**	**Marks**
1	**Part A** **Writing procedure**	10	35
	Conducting of Experiment :)Major Experiment(Group of Five)	10	
	Calculation, results, Inference	15	
2	**Part B (Study experiment)** **One question to be asked to explain (with sketch) any one component.**	**10**
3	**Viva**	**05**
	TOTAL	**50**

	Course Title: **MECHATRONICS LAB**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME57P**
	Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core (practice)**
CIE- 25 Marks			SEE- 50 Marks

Prerequisites: Mechatronics

Course Objectives:

1. To expose the students in Fluid power circuits, PLC based Fluid Power Control, Actuators, controllers and Virtual Instrumentation.

Course out comes

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked experiments**	**Linked PO**	**Teaching Hrs**
CO1	Understand the digital logic	*U/A*	1	2,3,4	**24**
CO2	Understand the concept of interfacing the various mechanical, electrical, electronics and computer systems	*U/A*	1,2,3,4,5,6,7	2,3,4	**15**
CO3	Know about the details of hydraulic and pneumatic Systems.	*U/A*	1,2,3,4,5,6,7	2,3,4	**30**
CO4	Design the circuits for hydraulic and pneumatic systems with PLC control	*U/A*	1,2,3,4,5,6,7	2,3,4	**15**
				Total sessions	**78**

Legend: R: remember U: Understand A: Application

Course –PO matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
MECHATRONICS LAB	0	1	3	2	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
PART A. PERFORMING EXPERIMENTS		
1	Design and Simulate the following digital circuits using MultiSim/any digital circuit simulator. Basic Logic Gates (i) Basic Logic Gates (ii) Demorgan's Theorem (iii) Combination Logic (iv) Encoders and Decoders (v) Flip-Flops	18
PART B. PERFORMING EXPERIMENTS (PLC)		

1	1. Draw the ladder rungs to represent
	  i. Two switches Normally Open and both have to be closed for the motor to operate.
	  ii. Either of the two Normally Open switches to be closed for the coil to be energised
		09

2.	Devise a timing circuit that will switch on for 20s and then switch it off.	06
3	Device a timing circuit that will switch on 10s and off 20s and so on	06
4	Device a circuit that can be used to start a motor and then to start a pump after delay of 50s. Then the motor is switched off 10s before the pump is switched off when the pump remains on for 50s.	09
5	Devise a circuit that can be used with the domestic washing machine to switch on a pump to pump water for 100s into the machine. Then switch on a heater for 50s to heat the water. The heater is switched off and another pump is switched on to empty the water for 100s.	09
6	Design and simulate of fluid power circuits to control (i)velocity (ii) direction of a single and double acting actuators	09
7	Design and Simulate a ladder diagram for car parking. (Hint: car is to be detected and enter the parking space to a particular location if space is available. If there is no space, a lamp should indicate that parking is full.)	09
	TOTAL	**78**

TEXT BOOKS AND REFERENCES

Sl.No.	Title of Books	Author	Publication
1.	Mechatronics	W.Bolton	Pearson education
2.	Mechatronics-Principles, Concepts and Applications	Nitaigour Premch and Mahalik	Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2006
3	Mechatronics	HMT	Tata McGraw Hill Publishers, New Delhi

4.	Programmable logic controllers	W.Bolton	Pearson education
5	Digital electronics	Flyod	-
6	Exploring PLC with applications	Pradeep Kumar Srivatsava	BPB publications

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeation should occur*

1	Visit to any of the nearest Electo-mechnaical based industries and the get report related to Mechanical operation performing using PLC and microcontroller.
2	Visit any of the nearest local service centre of automated Domestic washing machine get the information in the form report.(Make the Video when it is dismantled for presentation)
3	Visit the electrical and electronics laboratory and submit the report on construction and working of stepper motor when it is interfaced with any of the micro controller.

Course Delivery:

The course will be delivered through Demonstration and Shop practices

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	**CIE** (Continuous Internal Evaluation)	**IA** Tests	Students	Two Tests (Average of two tests to be computed)	**10**	Blue books	1,2,3,4
				Record Writing (Average marks of each exercise to be computed)	**10**	Record Book	1,2,3,4
				Activity	**05**	Report	1,2,3,4
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam		End of the course	**50**	Answer scripts at BTE	1,2,3,4
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1, 2 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, 4 Effectiveness of Delivery of instructions & Assessment Methods

Note: *CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination
Note:
1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.
3. Student suggested activities report for 5 marks
4. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

MODEL OF RUBRICS FOR ASSESSING STUDENT ACTIVITY

Dimension	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Student Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity

Note to IA verifier: **The following documents to be verified by CIE verifier at the end of semester**
5. Blue books (10 marks)
6. Student suggested activities report for 5 marks
7. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

	SCHEME OF VALUATION		
Serial no	**Description**	**Marks**	
1	**Part A** **Writing**	5	**15**
	Execution	10	
2	**Part B** **Writing**	10	**25**
	Execution	15	
3	**Viva**		**10**
		TOTAL	**50**

SYSTEM REQUIREMENTS

1. Computers with latest configurations-cpu-3.0GHz-RAM-2Gb/hdd-250Gb/dedicated graphics card1Gb
2. UPS-minimum 7.5 KvA
3. LCD projector-2 Nos.

SOFTWARE REQUIREMENTS

1. **MultiSim– Latest version with 20 user Licences**
2. **PLC – trainer Kit-5 nos each (Siemens/Allen Bradley/Keyence/Fanuc)**

	Course Title: **PROJECT WORK-I(Mechanical Stream)**		
	Scheme (L:T:P) : **0:1:2**	Total Contact Hours: **39**	Course Code: 15ME58P
	Type of Course: **Practice**	Credit **:-**	Core/ Elective: **Practice**
CIE- 25 Marks			

Prerequisites: Application learned concepts form the previous semester studied courses.

Course Objectives:

1. Learn the objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems/problems faced by industry/development of new facilities

2. Make the students come up with innovative/ new ideas in his area of interest.
3. Identify, analyze and develop opportunities as well as to solve broadly defined mechanical Engineering problems
4. Enhance students' appreciation of the values of social responsibility, legal and ethical principles, through the analysis and discussion of relevant articles and real time projects

Course outcome

On successful completion of the course, the students will be able to:

	Course Outcome	**CL**	**Linked PO**	**Allotted hours**
CO1	Get an idea and confidence in designing, analysing and executing the project.	Analysis/creation	1,2,3,4,8,9,10	
CO2	Apply the knowledge of latest trends in fabrication/ manufacturing and Relate their ideas while executing the project	Analysis/creation	1,2,3,4,8,9,10	
CO3	Have complete understanding of Executing the project	Analysis/creation	1,2,3,4,8,9,10	**3hrs/Week**
CO4	Prepare documents in team and enhance his written and oral communication presentations.	Analysis/creation	1,2,3,4,8,9,10	
CO5	Develop individual confidence to handle various engineering assignments and expose themselves to acquire life skills to meet societal challenges	Analysis/creation	1,2,3,4,5,8,9,10	
		TOTAL		**39 Hours**

MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

Course	Programme Outcome									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	Basic knowledge	Discipline knowledge	Experiments a practice	Engineering Tools	Engineer and society	Environment & Sustainability	Ethics	Individual and Team work	Communication	Life long learning
PROJECT WORK	1	3	3	2	1	0	0	3	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

1. PROJECT WORK: 39 HRS

A. INTRODUCTION

The objective of the project work is to enable the students in convenient groups of minimum of 5 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

B. ROAD MAP FOR THE PROJECT

1. Carry out a session or a seminar from the ISTE Student Chapter coordinator / Programme coordinator with the help of Innovation club / I I I cell for directing the students to identify project areas in the field of their interested including interdisciplinary areas.
2. Power point presentation in seminar should include detail description of project areas related to program, Project report formats, developing personnel writing skills.
3. The Students/Departments may at liberty to form the batch not less than 5 and maximum 8 and get registered with project coordinator/HOD at the end of V semester.
4. Students should take the approval from the Project committee/ Head of department for doing project.
5. After approval the batch of students will be published in department notice board along with guide in the end of 5th semester.
6. All students should finalize their Project immediately before commencement of SEE of 5th semester.
7. The types of project may include:
   - Industrial case study

- Preparation of a feasibility report
- Design and development of equipment.
- The overhauling of existing equipment
- Creation of New facilities

8. The project should be challenging but manageable within the resources and time available.
9. Students should undergo reviews for one times in 5th and one times in 6th semester during the internal assessment. Time table for IA should include project review. The guide should monitor the progress of Project work periodically and it should be finally evaluated for 25 marks at the end of 5th semester and for 25 marks at the end of 6th semester.
10. The IA marks will be evaluated based on oral presentation and assessment by the internal guide by adopting Rubrics being developed by Project committee.
11. Real time problems, Industry related problems, should be chosen and it is a Responsibilities of the project committee / Programme coordinator/ Innovation club / I.I.T. cell to choose the appropriate project and to accept the Project Proposal
12. **Identification of Topic:** The selection of topic is of crucial importance. It should be field of interest. It is advisable to choose the project can be completed on time and within the budget and resources. The topic should be clear, directional, focussed and feasible.
13. An outline of project proposal submitted & synopsis from student will initiate a dialogue between Student and Project coordinator who will then help you to work on the chosen topic and report.

C. Industrial visit

Students are required to undergo an industrial visit for period of at least 3(Three) working days, in V semester only. After completion of their visit the reports should be prepared. Each Student should write the report independently in view of his own observation in industry. All days for the visit should be accounted for clearly giving attendance particulars. The concern accompanying staff is to check student presence and access progress periodically

D.Industrial report

Students are required to submit a comprehensive report on factory visit with details of the organization where the training was undergone. The comprehensive report should focus on study of plant/ product /process/ along with intensive in-depth study on anyone of the topics such as processes, methods, tooling, plant layout and equipment, highlighting aspects of quality, productivity of the system. Any data, drawings etc should be incorporated with the consent of the Organization. The comprehensive report should be submitted for the end exam for evaluation

E. Thrust areas identified for Project work

Each student may be assigned any one of the following types of project/thesis work:

According to the local needs, the following major projects are suggested:

1. Non-conventional energy

- Low Cost Solar Water Heating System for Domestic Purpose
- Fabrication of Solar cooker
- Study of Community Biogas Plant
- Fabricate a thermally efficient wood burning stove
- Solar lamps
- Solar powered refrigerator

2. Mechatronics/Material handling area

- Motorized object lifting jack
- Key controlled- fork lifter
- Object counting machine
- Stepper motor control with selected steps for conveyor belts
- Robotic arm with gripper
- Material handling device in X,Y,Z motion control
- Robotic crane
- Robotic trolley for material handling

3. Fluid power and control area

      Pneumatic/Hydraulic jack
      Pneumatic/hydraulic crane
      Air compressed spray gun
      Pneumatic transport system

4. Automobile related area

      Regenerative braking system
      Steering controlled headlight
      Engine/motor vibration checker
      Seat belt automatic locking system
      Hydraulic braking
      Electromagnetic shock absorber
      Digital auto speed limiter

5. Motorized wheel chair

6. Design and Fabrication of various types of lab equipment's useful to polytechnic

7. Repair and overhauling of various machine tools and lab equipment's available at polytechnic

8. Critical Study of existing quality systems and inventory control at industry

9. Mechanical industry fabrication related projects

10. Automatic mopping machine to clean the floor area

11. Automatic milling machine with digital control

12. PCB fabrication

13. Any study project related to Mechanical and allied areas in industry

14. Any project related to industry based problems

15 .Any projects related to low cost automation

F. Course Assessment and Evaluation Scheme for Project work

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment met	CIE	IA	Students	At the end of 5 semester)	25	1. Project Synopsis. 2. Plan & Schedule 3. Industrial visit report	CO1, CO2, CO3,CO4,CO5
				At the end of 6 semester)	25	1. Project Report. 2. Presentation hand outs	CO1, CO2, CO3,CO4,CO5
	SEE	End Exam		End of the course	Project report project model/Study report		
Indirect Assessment	Student Feedback on course		Students	Middle of the course	Feedback forms		CO1Delivery of course
	End of Course Survey			End of the course	Questionnaires		CO1 to CO5 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation   ***SEE** – Semester End Examination

G. Project report

The Project Report should consist of following items.

1. Introduction
2. Review of Literature
3. Study Area
4. Methodology/Design/fabrication/Tests
5. Result and Discussion
6. Conclusion and scope for future study
7. References.

1. Project reports should be typed neatly in Times New Roman letters with font size 14 for titles and 12 for text on both sides of the paper with 1.5 line spacing on a A4 size paper (210 x 297 mm). The   margins should be: Left - 1.5",   Right - 1", Top and Bottom - 0.75".

2. The total number of reports (**Soft bound**) to be prepared are

▪ One copy to the department /library

- One copy to the concerned guide(s)
- One copy to the candidate.

3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

4. Every copy of the report must contain

➢ Inner title page (White)

➢ Outer title page with a plastic cover

➢ Candidate declaration and Certificate in the format enclosed both from the institution and the organization where the project is carried out.

➢ An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

5. The organization of the report should be as follows

| 1. Inner title page
2. Abstract or Synopsis
3. Acknowledgments
4. Table of Contents
5. List of table & figures (optional)	Usually numbered in roman

Chapters(to be numbered in Arabic) containing Introduction-, which usually specifies the scope of work and its importance and relation to previous work and the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.

The **chapter must be left or right justified** (**font size** 16). Followed by the **title of chapter centered** (**font size 18**), **section/subsection numbers along with their headings must be left justified** with **section number and its heading in font size** 16 and **subsection and its heading in font size** 14. The **body or the text** of the report should have font size 12.

The figures and tables must be numbered chapter wise

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

Reference or Bibliography: The references should be **numbered serially** in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.

1. For textbooks – Dr.Paramar S, Welding process and technology, Khanna publishers, New Delhi, 2 Edition, 2003.

2. For papers – Y.Javadi and I.sattari, Welding distortion in pipes, Journal of pressure vessels and piping, Vol 85, Aug 2008, pp 337-343

Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g.

▪   **V = IZ**   ....   **(3.2)**

All equation numbers should be right justified.

Separator sheets, used if any, between chapters, should be of thin paper

H.CIE ASSESSMENT FOR FIRST REVIEW(V Semester)

1. Project identification   05 mark

2. Project synopsis   10 mark

3. Industrial visit & Report   10mark

25 Marks

MODEL OF RUBRICS FOR ASSESSING REVIEWS OF PROJECT FOR CIE

Student name	Reg no	Dimension	Scale					Students Score				
			Unsatisfactory	Developing	satisfactory	Good	Exemplary	1	2	3	4	5
		Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic					
		Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles					
		Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.					
		Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount					
		Grand Average/Total										

Directorate Of Technical Education   Karnataka StateMECH   15ME58P

TITLE OF PROJECT REPORT

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A PROJECT REPORT

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Submitted by

<Font Size 14><Italic>

NAME OF THE CANDIDATE(S)

<Font Size 16>

in partial fulfilment for the award of the diploma

of

<Font Size 14><1.5 line spacing><Italic>

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME

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IN

DEPARTMENT OF MECHANICAL ENGINEERING

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LOGO

NAME OF THE COLLEGE

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DEPARTMENT OF TECHNICAL EDUCATION

BENGALURU-560001

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Year of submission: (MONTH & YEAR)

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8

(A typical Specimen of Title Page) <Font Style Times New Roman – Bold>

A Project Report
on

<TITLE OF THE PROJECT WORK>

Submitted for partial fulfilment of the requirements for the award of the
of

DIPLOMA IN CIVIL ENGINEERING

BY
BATCH
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>

Under the guidance of

<Name of the Staff>
Lecturer
Department of ME
GPT, Place--------

Department of Mechanical Engineering
<<**NAME OF INSTITUTE**>>
<<**ADDRESS OF INSTITUTE**>>

(A typical specimen of Bonafide
Certificate)
<Font Style Times New Roman>

DEPARTMENT OF TECHNICAL EDUCATION
BENGALURU-560001
<Font Style Times New Roman – size -18>

BONAFIDE CERTIFICATE
<Font Style Times New Roman – size -16>

<Font Style Times New Roman – size -14>

Certified that this project report **"……….TITLE OF THE PROJECT…………….."** is the bonafide work of "**…………..NAME OF THE CANDIDATE(S)………….**"who carried out the project work under my supervision.

<<Signature of the Head of the Department>>   <<Signature of the Project cordinator>>

SIGNATURE   **SIGNATURE**

<<Name>>   <<Name>>

HEAD OF THE DEPARTMENT   **PROJECT CORDINATOR**

<<Academic Designation>>

<<Department>>   Department of Mechanical Engineering

<<Full address of the Dept & College >>   <<Full address of the Dept &
College >>

Examiners 1......................<<Signature, Name, Designation& Address>>........

Examiners 2......................<<Signature, Name, Designation& Address>>........

CANDIDATE'S DECLARATION

I, --- a student of Diploma in ----------------------------- Department bearing Reg No-------------------------------------of --- hereby declare that I own full responsibility for the information, results and conclusions provided in this project work titled "---"submitted to **State Board of Technical Examinations, Government of Karnataka** for the award of Diploma in ---------------------------------.

To the best of my knowledge, this project work has not been submitted in part or full elsewhere in any other institution/organization for the award of any certificate/diploma/degree. I have completely taken care in acknowledging the contribution of others in this academic work. I further declare that in case of any violation of intellectual property rights and particulars declared, found at any stage, I, as the candidate will be solely responsible for the same.

Date:

Place: **Signature of candidate**

---   **Name: ----------------**

--   **Reg No----------------**

DEPARTMENT OF TECHNICAL EDUCATION

NAME OF THE INSTITUTION

Address with pin code

Department of …………………………………………………….

CERTIFICATE

Certified that this project report entitled -- ---- ---**"**which is being submitted by Mr./Ms. …………………………………………….., Reg. No…..……………, a bonafide student of ………………………………….in partial fulfilment for the award of **Diploma in -----------------Engineering** during the year ……………………... is record of students own work carried out under my/our guidance. It is certified that all corrections/suggestions indicated for internal Assessment have been incorporated in the Report and one copy of it being deposited in the polytechnic library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said diploma.

It is further understood that by this certificate the undersigned do not endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the project only for the purpose for which it is submitted.

Guide(s)

Name and signature

Examiner   1

       2   **Head of Department**

Dept. of --------------------

Format of Synopsis

1. Title of the Project

2. Objectives of the study

3. Rationale for the study

4. Statement of the Problem

5. Detailed Methodology to be used for carrying out the study

6. The expected contribution from the study (to perform any laboratory experiments)

7. List of activities to be carried out to complete the project (with the help of a bar chart showing the time schedule)

8. Places/labs/equipment and tools required and planning of arrangements

9. Problems envisaged in carrying out the project, if any.

10. Brief description of project in 100 words

Directorate Of Technical Education   Karnataka StateMECH   15ME58P

	TASK	Responsibility	END OF V SEMESTER					VI SEMESTER													
	WEAKS		11	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Industrial visit	Students/Faculty	■																			
1	Seminar regarding Project work	Project Com/HOD		■																		
2	Batch formation &Guide allocation	HOD			■																	
3	Identification of project	Students/Guide				■																
4	Project synopsis Submission	Students					■															
5	Finalisation of Project	Students/Guide						■														
6	Literature survey	Students/Guide						■														
7	Identification of facility to do PW	Guide							■	■												
8	Study/Fabrication/design of model	Students/Guide									■	■	■	■	■	■	■	■			
9	Results discussion/performance testing	Students																	■		
10	Review of Project work by guide	Students																		■	
11	Project report submission	Students/Guide																			■

	Course Title: **ESTIMATION AND COSTING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME61T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**
CEE:25 Marks			SEE:100 Marks

Prerequisites: Knowledge of Mathematics, Work shop technology, Machine Tool Technology

Course Objectives:

This course will also help in developing the skills required in Estimate production/operation cost for budgeting and analysis.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand the concept of estimation and costing. Analyze the concept of depreciation cost.	*R/U/A/Ev*	1,2	**08**
CO2	Know the components of costing and Determine material cost of simple machine components.	*R/U/A/Ev*	1,2	**10**
CO3	Ability to estimate the various machining operations.	*R/U/A*	1,2	**10**
CO4	Ability to estimate the various Welding & Sheet metal components.	*U/A*	1,2	**09**
CO5	Ability to estimate the various Forging & Foundry Shop components.	*U/A*	1,2	**09**
CO6	Understand the concept of Process costing, and types of Budget, and familiarize with accounting terminology.	*U*	1,2	**06**
		Total sessions		**52**

Legend: R: Remember U: Understand A: Application An: Analysis

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
ESTIMATION AND COSTING	1	3	0	0	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	Introduction to Estimation & costing	08	5	5	10	20	13.79
2	Estimation of materials cost	10	5	5	20	30	20.68
3	Estimation of Cost in machine shop	10	5	10	20	35	24.16
4	Estimation of Cost in Welding & Sheet metal shop	09	-	5	20	25	17.24
5	Estimation of Cost in Forging shop & Foundry Shop	09	-	5	20	25	17.24
6	Process costing & Accounting	06	-	10	-	10	6.89
Total		52	15	40	90	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: INTRODUCTION TO ESTIMATION & COSTING   08 Hrs
Estimation - Definition, Importance and Aims- Qualities and functions of an Estimator- Source of errors in estimation- Constituents of Estimation- Costing - Definition and Aims - Difference between costing and estimating- - Depreciation and obsolescence: Definition, types, different methods of calculating depreciation- numeric examples.

UNIT II: ESTIMATION OF MATERIALS COST   10 Hrs
Material - Direct material, indirect material and examples- Calculation of Material cost - Labour - direct, indirect labour and examples - Calculation of labour cost - Expenses - direct, indirect expenses and examples- Classification of expenses - factory, administrative, selling and distribution expenses - Fixed and variable expenses - Components of cost - prime cost, factory cost, office cost, total cost - Block diagram to show the relationship between elements and components of cost -Determination of selling price - Break even analysis - break event

chart, diagram to illustrate break event point-Estimation of materials cost of step pulley, spindle lathe centre, Rivets, Fly wheel, Crankshaft, Chain link, Wedge and Gib-headed key.

UNIT III: ESTIMATION IN MACHINE SHOP   10 Hrs

The terminology associated with machine shop estimation- Definition of cutting speed, feed, depth of cut- Procedure of estimating cost of machined part for following operations: Lathe operations (Facing, outside/inside turning, boring, drilling on lathe, grooving and threading). Drilling operations (Drilling, reaming, tapping)-Shaping operations- Milling operations (Face milling, side and face cutting, end milling)- Cylindrical grinding operations (Plain cylindrical grinding)- For given machined part, estimate material cost and machining cost.

UNIT IV: ESTIMATION IN WELDING & SHEET METAL SHOP   09 Hrs

Estimation in welding shop - gas welding cost, arc welding cost - production cost of given welding job- the types of welding costs- the factors affecting the welding cost.
Estimation in sheet metal shop - Sheet material and gauge number, Sheet metal joints - Estimate the material required for preparation of container open on one side, Cylindrical drum, funnel and tray.

UNIT V: ESTIMATION IN FORGING SHOP & FOUNDARY SHOP   09 Hrs

Cost terminology associated with forging shop- The procedure for calculating material cost of a product for forging shop- Procedure for estimating forging cost- forging losses to be considered while estimating -Estimation of forging cost.
Estimation in foundry shop-pattern allowances- The procedure for calculating material cost of a product for foundry shop - Procedure for estimating cost of pattern making. -Procedure for estimating foundry cost of components such as C.I pulley and C.I. Wheel and estimate foundry cost.

UNIT VI: PROCESS COSTING & ACCOUNTING   06 Hrs

Process & Job Costing -Characteristics -Principles -Procedure for Process costing.
Wages-types, Incentives-types, Budget-Types, Accounting terminology like -book value-Net Present Value-Work in progress- Gross Domestic Product (GDP)-balance sheet-Tendering-manual tendering and e-tendering.

TEXT BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Mechanical estimation and costing	T.R.Banga and S.C.Sharma	Khanna publishers
2.	Mechanical Estimation	Malhothra	-
3	Industrial Organisation and Engineering Economics	T.R.Banga and S.C.Sharma	Khanna publishers
4.	Mechanical Estimation	NITTTR Chennai	NITTTR Chennai
5	Mechanical costing and estimation.	Singh and Khan	Khanna Publishers
6	Process planning & cost estimation	M.Adithan	New age International

i.   http://calculatoredge.com/index.htm#mechanical

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	Introduction to Estimation & costing	Lectures, Discussions Presentations
2	Estimation of materials cost	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts
3	Estimation of Cost in machine shop	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts
4	Estimation of Cost in Welding & Sheet metal shop	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts
5	Estimation of Cost in Forging shop & Foundry Shop	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts
6	Process costing& budget	Discussions, real life industries situation, industrial visits

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Collect the finished parts from industries/market/scrap merchants Measure the dimensions and prepare production drawings of the parts using A4 size paper. Estimate the material cost
2	**Welding estimation:** a. Determine raw material volume for all welded parts. b. Select welding rod to be used. Estimate quantity of welding rod required. c. Determine material and consumables costs. d. For each part, estimate welding cost. Show the assumptions and steps followed to estimate welding cost. e. Derive total cost of the part.
3	**Casting estimation:** a. Determine raw material volume for all casted parts (Determine input weight, cut weight, net weight, losses etc.). b. Prepare pattern drawings (production drawings with all dimensions, surface finishes, allowances, etc.) for all parts. c. Estimate pattern cost. d. Determine material and consumables costs. e. For each part, estimate casting cost. Show the assumptions and steps followed to estimate casting cost. f. Derive total cost of the part.
4	**Forging estimation:**

			a. Determine raw material volume for all forged parts. b. Prepare die drawings (production drawings with all dimensions, surface finishes, allowances, etc.) for all parts. c. Estimate dies cost. d. Determine material and consumables costs. e. For each part, estimate forging cost. Show the assumptions and steps followed to estimate forging cost. f. Derive total cost of parts.
5			**Machining estimation:** a. Determine raw material volume for all machined parts. b. For each part, tabulate operation, cutting tool/s to be used and cutting parameters (speed, feed and depth of cut) to be used. c. Estimate raw material cost. d. For each part, estimate machining cost. Show the assumptions and steps followed to estimate machining cost. e. Derive total cost of parts

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	VI SEM	**ESTIMATION & COSTINNG**	20
	Year: 2016-17	Course code:15ME61T	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Define estimation. List the aims of estimating	05	U	01	2
2	Name the various components of cost. Give brief descriptions of the component.	05	R	02	2
3	A machine was purchased for Rs 30000/-. The cost of erection charges was Rs 10000/- , the estimated life of the machine was 20 years. The scrap value at the end of useful life was Rs 8000/-. Determine the rate of depreciation per year by straight line method. After 10 years the machine underwent major repairs and the repair cost was Rs 6000/- .What will be the new rate of depreciation per year.	10	A	01	1,2

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Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. Define estimation. Mention the aims of estimating
2. Explain the Straight line method of calculating depreciation
3. Name the various components of cost. Give brief descriptions of the component.
4. Distinguish between fixed and variable overhead
5. Define cutting speed, feed, depth of cut for lathe operations
6. Explain the Procedure of estimating cost of machined part for Lathe operations
7. Explain the various operation time to be considered for estimation of machining time.
8. Explain the types of sheet metal joints.
9. Explain the pattern allowances.

PART-B   7x10=70 marks

1. An industrial plant with initial value of Rs. 400000/- has a salvage value of Rs.50000/- at the end of 25 years, but sold for 260000/- at end of 10years. What is the profit or loss to the owner, if sinking fund method of depreciation is adopted? Take interest rate @ 8%.
2. A catalogue price of a machine is Rs 6000/- and the discount allowed to the distributors is 20% of the catalogue price. At some stage, it was found that the selling expenses were half the factory cost and material cost, labour cost and the factory overheads were in the ratio of 1:4:2 if the material cost was Rs 400/-. What profit was made by the factory on each machine
3. Determine the number of rivets of dimensions as shown in the figure. Which can be manufactured from 4 Kg of MS. Assume that there is no wastage of material density of MS is 8 gm/cc. All dimensions are in cm.

4. A tapered component is to be manufactured in a lathe by compound rest method out of a given bar of 60mm dia and 100 mm length. Assume the following data:

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Details of tapered components

        Major dia   =60mm
        Minor dia   =20mm
        Length of taper =100 mm

Cutting speed 75 m/min. hand feed by compound rest =0.05 mm/rev depth of cut should not exceed 4 mm. Determine the time required for machining. All dimensions are in mm.

5. A 20 X 7.5 cm CI surface is to be faced on milling machine with a cutter having a diameter of 125 cm and 20 teeth. If the cutting speed and feed are 50m/min and 4.5 cm/min respectively, determine the milling time, rpm of the cutter and feed per tooth.

6. Estimate the time required for making an open tank of size 50x50x50 cm by gas welding. Size of sheet used is 50x50x0.3 cm welding is to be done on both sides. Assume fatigue allowance to be 10% and welding speed outside as 6m/hr and inside 5m/hr.

7. Two 1m long MS plates of 10mm thickness are to be welded by a lap joint with the help of a 6 mm electrode. Determine the cost of welding
   a. Current used   :250 amp
   b. Voltage   : 30 V
   c. Welding speed   : 10m/hr
   d. Electrode used   : 0.4 kg/m of welding
   e. Labour charges Rs 1/ hr
   f. Power charges Rs 0.20/KWh   Cost of electrode Rs 5/kg

8. Estimate the size of stock and weight of material required to forge 100 MS bolts as shown in figure. The bar stock diameter is 3 cm.

9. Estimate the cost of 2000 CI pulleys as shown in figure. Its surfaces are to be machines after casting. The pattern is supplied by the customer itself. Following data can be used:

    Cost of metal   = Rs.5/kg
    Moulds prepared by each worker/day=20
    Melting charges   = 20% of metal cost
    Machining allowance on each side may be taken as 2mm
    Wages of each moulder =Rs. 16/day
    Density of CI   = 7.2 gm/cc
    Overhead charges   = 25% of metal cost.
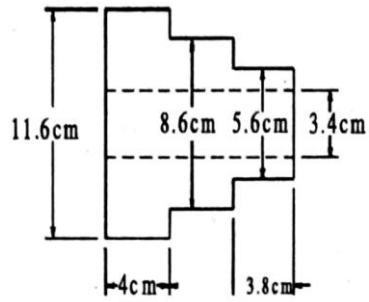
10. a) Explain the procedure for process costing
    b) Compare manual tendering with e-tendering

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Diploma in Mechanical Engineering
VI Semester
Course title: ESTIMATION & COSTING

CO1: Understand the concept of estimation and costing and Analyse the concept of depreciation cost.

REMEMBERING

Chapter-I: Introduction to Estimation and costing

1. Define estimation.
2. List the functions of an estimator.
3. Define costing.
4. List the various costing methods
5. What are the advantages of efficient costing?
6. Define standard cost. Write the advantages of standard cost.
7. Define the following terms
    a. Depreciation
    b. Estimation.
8. Define obsolescence. List the various methods of calculating depreciation
9. List the causes of depreciation
10. Name six methods of calculating depreciation.
11. List the aims of estimating
12. List the essential qualities of an estimator.

UNDERSTANDING

10. Explain the various qualities of estimator
11. Explain the procedure for carrying out estimation.
12. What are the sources of errors in estimating
13. Explain the idleness in industries and list the various form of idleness.
14. Explain the need of an estimation for industrial project
15. Compare estimation with costing
16. Explain the steps involved in estimating procedure.
17. Explain the Straight line method of calculating depreciation
18. Explain the Sinking fund method of calculating depreciation
19. Explain the diminishing balance method for calculating the depreciation
20. Explain the terms
    a. Repair and maintenance
    b. Obsolescence
21. Explain the aims of estimation
22. Explain on the various functions of an estimator
23. Compare man hour rate with machine hour rate
24. Comparison depreciation with obsolescence
25. Explain fixed instalment method of depreciation

9. A machine was purchased for Rs 30000/-. The cost of erection charges was Rs 10000/- , the estimated life of the machine was 20 years. The scrap value at the end of useful life was Rs 8000/-. Determine the rate of depreciation per year by straight line method. After 10 years the machine underwent major repairs and the repair cost was Rs 6000/- .What will be the new rate of depreciation per year?

    .

10. The installation cost was Rs 11950/-. The apparatus has a life expectancy of 20 years with a scrap value of Rs 6000/-. What should be the rate of depreciation and depreciation fund on 1.1.1990 by reducing balance method?

11. A lathe is purchased for Rs 80000/-. The assumed life is 10 years and scrap value Rs 8000/-. If the depreciation is charged by diminishing balance method. Determine the rate by which the value of lathe is reducing every year and Estimate the depreciation fund after 2 years.

12. A machine is purchased for Rs 60000/-. The estimated life of machine is 15 years and the scrap value is Rs 15000/-. Determine the depreciations per year by using interest law (Sinking fund) method, if the rate of interest is charged at 5%. Estimate the depreciation at the end of 5 years.

13. An industrial plant with initial value of Rs. 400000/- has a salvage value of Rs.50000/- at the end of 25 years, but sold for 260000/- at end of 10years. What is the profit or loss to the owner, if sinking fund method of depreciation is adopted? Take interest rate @ 8%.

14. A machine was purchased for Rs.40000/- the useful life of machine is 15 years. The scrap value of the machine is Rs.1000/- . after 5 years, the machine was sold for Rs.24000/-. If depreciation was set aside by sinking fund method, the rate of interest @ 8%, determine the extra capital needed to purchase the new machine for Rs.50000/-.

15. The cost of the machine is Rs. 16000 and its scrap value is Rs.4000/-. Determine the depreciation by "sum of the years digits method "charges for the year, if the estimated life of the machine in 4 years.

16. Determine the depreciation at the end of each year by the sum of years digits method (SYD), if the life of the plant is 5 years. The assets of the company are Rs.360000/- and scrap value is Rs.60000.

CO2: know the components of costing and Determine material cost of simple machine components..

REMEMBERING
1. List out the various elements of cost
2. Name the various components of cost.
3. List the various indirect expenses.

UNDERSTANDING
4. Compare direct expenses with indirect expenses.
5. Comparison fixed with variable overheads.
6. Explain the overhead charges.
7. Explain the following a) personal allowance b) fatigue allowance
8. Explain the control on prime cost, control on overheads and control over indirect materials and tools.
9. Explain the unit rate method designed for allocation of on cost
10. Explain each element of cost with suitable examples
11. Explain each components of cost with suitable examples

12. Illustrate various elements of cost in determining the price of a product with the help of a block diagram.
13. Explain a) Prime cost b) Direct material Cost c) Direct labour cost
14. Explain the method involved in calculation of direct material cost.

APPLICATION/EVALUATION

1. The direct material used is Rs 1000/- and the direct wages are Rs 443/- for the manufacture of certain items. Determine the factory cost, when the oncost is to be 60% of prime cost.
2. A certain articles are manufactured in bathes of 100. The direct material cost is Rs. 250/- , direct labour cost Is Rs.400/- and factory overheads is Rs. 290/-. If the selling on cost is 40% of prime cost. What should be the selling price of each product to obtain a profit of 20% on the selling price?
3. A machine is manufactured by a firm in batches of 100. The direct material cost is Rs 1600/- and direct labour cost is Rs 2000/-. Factory on cost is 30% of the prime cost. Overhead charges are 20% of factory cost. If the management wants to make a profit of 10% on the selling price. Determine the selling price of each machine.
4. A concern produces bolts & nuts of aluminium and estimated cost is given on the basis of a lot of 1000 bolts with nuts, length of bolt with head 10cm and diameter 2cm.
   - i) Material cost Rs 700
   - ii) Labour cost (direct)
     - a) Cutting and setting up =Rs 150
     - b) Milling, threading, drilling = Rs 160/-
   - iii) Cost of tools   =Rs 100/-
   - iv) Factory overheads   =150% of total labour cost
   - v) Office on cost   = 30% of factory cost
   - vi) Selling price   = Rs 2/ piece

   Determine whether management is making profit or loss per piece.
5. Estimate the total cost of two products A & B of on cost is 60% of prime cost. The product has Rs 200/- as direct material and Rs 400/- as direct labour cost, While the product B has Rs 300/- as direct labour cost and Rs 300/- as direct material cost.
6. A lot of 5000 pieces of an item was fabricated and the following cost were incurred
   - Material cost   Rs 1000/-
   - Labour cost   Rs 1100/-
   - Cost of tool/etc Rs 125/-
   - Factory oncost   150% labour cost
   - Office oncost   25% of factory cost
   - Selling expenses 20% of oncost production

   What should be the profit or loss if the price of each item is fixed at Rs 1.50

7. A catalogue price of a machine is Rs 6000/- and the discount allowed to the distributors is 20% of the catalogue price. At some stage, it was found that the selling expenses were half the factory cost and material cost, labour cost and the factory overheads were in the ratio of 1:4:2 if the material cost was Rs 400/-. What profit was made by the factory on each machine.
8. A market price of a machine is Rs 50000/- and the discount allowed to the distributor is 20% of the material price. Selling expense cost is ¼ of the factory cost. If the material cost, Labour cost and factory overhead charges are in the ratio of 2:4:1, What profit is going to be made by the factory on each machine, if the material cost is Rs 8000/-.

9. An article can be made either by hand or in large quantities by mass production. In the farmer case, time taken is 3hrs and overheads is 25% of labour cost. While in the later case time taken for 10 pieces is 8Hrs, but overheads are 150% of the labour cost, material cost is Rs 15/ piece and labour charges are Rs 8/Hr. Compare the total cost in both the cases. Which is cheaper?

10. A factory owner employed 50 workers during the month of march 2000. Whose details of expenditure are as given below: a) Material cost is Rs 100000/- b) Rate of wages for each worker is Rs 6/Hr c) Duration of work is 8hrs/day d) No. of holidays in the month is 6 days and e) Total overhead expenses is Rs 50000/-. If workers were paid overtime of 200Hrs at the rate of Rs10/Hr. Determine i) Total cost ii) Man hour rate overheads

11. Estimate the weight of cast iron used in manufacturing step pulley as show in figure. Assume density of CI as 7.2 gm/cc.

All dimensions are in cm
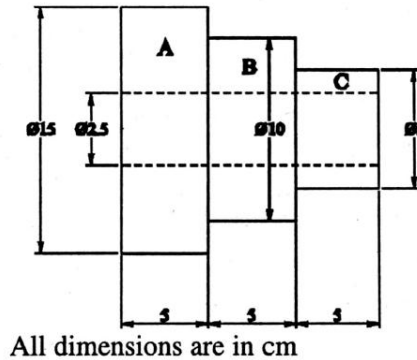
12. Determine the weight and cost of material of MS spindle as shown in figure. The density of MS is 7.8 gm/cc and rate is Rs.15 per Kg.
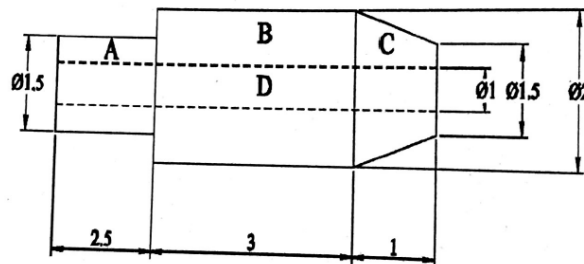
13. Determine the number of rivets of dimensions as shown in the figure. Which can be manufactured from 4 Kg of MS. Assume that there is no wastage of material density of MS is 8 gm/cc. All dimensions are in cm.
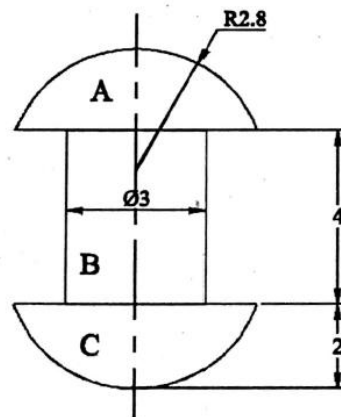
14. Figure shows a lathe centre. Evaluate the weight and cost of the material which weighs 7.85 gm/cm^3. The cost of the material is Rs. 20 per kg.

All dimensions are in mm
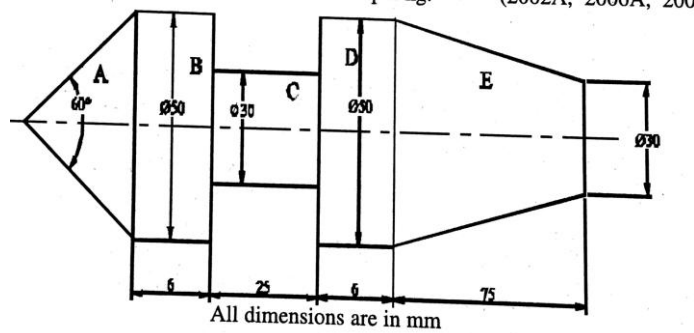
15. Estimate the volume of the material required for manufacturing 100 pieces of shaft shown in figure. The shaft is made-up of MS weights 8 gm/CC and cost is Rs.60 per kg. Determine the material cost for such shafts.


All dimensions are in cm
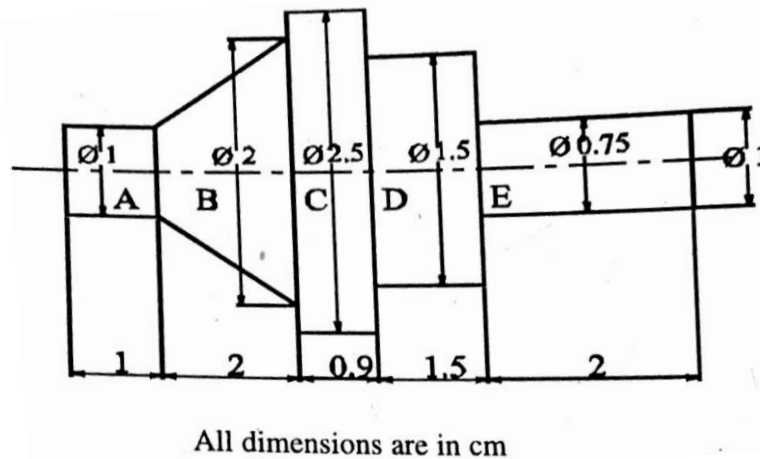
16. Determine the weight and cost 200 articles of MS as shown in figure. Assuming suitable density and the material cost as Rs.12 per Kg.

All dimensions are in mm
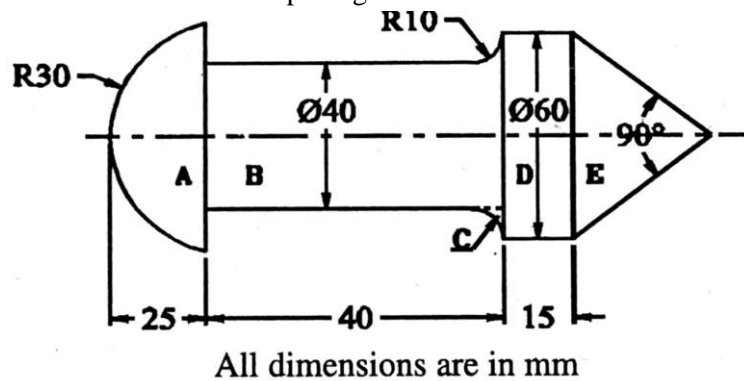
17. Determine the material cost of ten gun metal bushes of 15 cm length including flanges at both the internal dia. Of the bush is 4 cm, external dia is 8 cm and outer dia of the end flanges is 12 cm. assume density of metal as 8.5 gm/cc and cost of the material is Rs.200/kg.

18. Determine the weight of the gear blank of CI as shown in figure. Taking its density as 7.4 gm/cc.

All dimensions are in cm
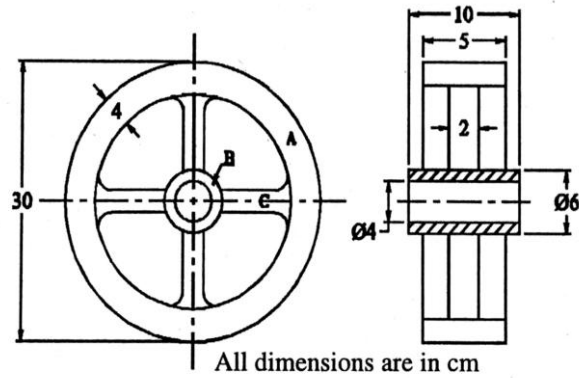
19. Estimate the material cost of an engine flywheel from the following data:

Inside dia of the flywheel rim	=70 cm
Outside dia of rim	=100 cm
Width of rim	=25 cm
Inside dia of hub	=12 cm
Outside dia of hub	=24 cm
Length of hub	=30 cm
Section of arms (elliptical)	=7 cm X 4 cm
Length of arm	=23 cm
No. of arms	=4
Density of material	=8 gm/cc
Material cost	= Rs.25/kg
Neglect tapering of arms .	

CO3: Ability to estimate the various machining operations

REMEMBERING
1. List the various operations performed in machine shop.
2. Define cutting speed, feed, depth of cut for lathe operations
3. Define cutting speed, feed, depth of cut in lathe

UNDERSTANDING
1. Explain the various operation time to be considered for estimation of Machining time.
2. Explain the Procedure of estimating cost of machined part for Lathe operations
3. Explain the Procedure of estimating cost of machined part for Milling operations
4. Explain the Procedure of estimating cost of machined part for Cylindrical Grinding operations.

APPLICATION
1. Estimate the time required to turn 3.5 cm dia bar to dimension shown in figure. Cutting speed is 15.4 m/min and feed is 1 mm/rev. all cuts are 3.5 mm deep.
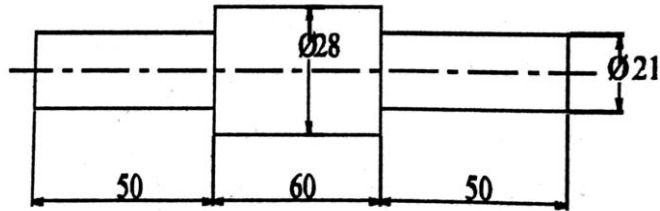
2. (a) How much time will be required to reduce a 42mm bar to dimension shown in figure. With cutting speed 16.5 m/min and feed is 1 mm/rev. assume all cuts are 2.5 mm deep. (b) How long will it take to machine a 45° X 3.125 mm chamfer?
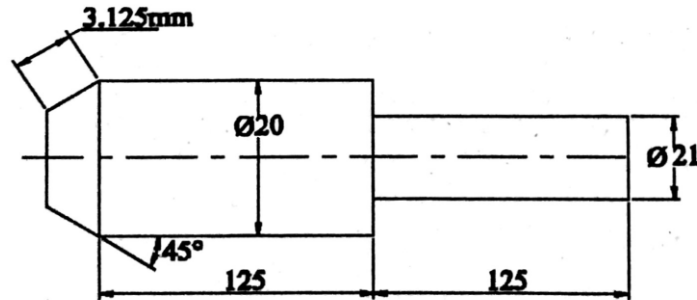
3. Estimate the time required to run a 60mm dia rod to the dimension shown in figure. Taking cutting speed as 20m/min, feed as 1.2 mm. all cuts are 3mm deep. All dimensions are in mm.
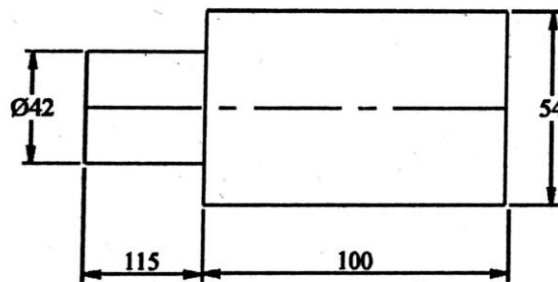
4. A tapered component is to be manufactured in a lathe by compound rest method out of a given bar of 60mm dia and 100 mm length. Assume the following data:

   Details of tapered components
        Major dia   =60mm
   Minor dia   =20mm
        Length of taper =100 mm

    Cutting speed 75 m/min. hand feed by compound rest =0.05 mm/rev depth of cut should not exceed 4 mm. Determine the time required for machining. All dimensions are in mm.

5. A component shown in figure is to be knurled on the surface. Estimate the time required for knurling it, if the cutting speed is 20m/min and feed is 0.03 cm/rev.
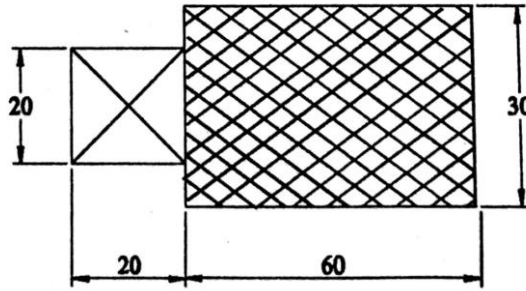
6. Determine the time required for drilling component as shown in the figure. Assume cutting speed as 22 m/min and feed as 0.02 cm/rev. all dimensions are in mm.
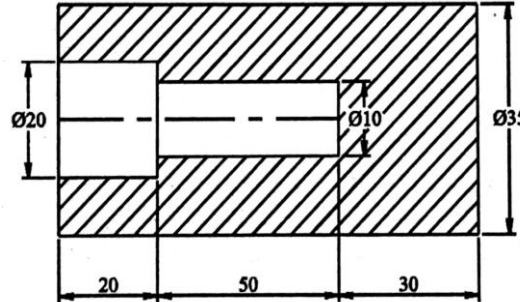
7. Estimate out the time for threading on a 3 m dia aluminium bar of length of 10cm by single point tool, if 3threads/cm are to be cut and speed bar is 80rpm. Assume suitable approach over run and no. of cuts.

8. Determine the time required for cutting two threads/cm on aluminium bar stock of 3.5 cm diameter and for a length of 10cm. assume cutting speed as 11m/min. neglecting approach and overtake for the tool.

9. Estimate the time required for tapping a 2cm dia. Hole with a 3 mm pitch tap in a MS plate upto a depth of 3cm. assume cutting speed as 10m/min and return speed of tap as 2 times the cutting speed.

10. Estimate out the time required for tapping a 2.1 cm dia hole with 2.5 mm pitch tap in a mild steel plate upto a depth of 3.5cm. assume cutting speed as 11m/min and also assume that return speed of tap is twice the cutting speed. No. of cuts required is 6.

11. What is the feed per tooth of a 32 teeth milling cutter of 40 cm dia , having a speed of 75 rpm, table feed 30per min. also Estimate the time required to face mill a CI casting 1.5 m long and 24 cm wide.(take allowances into consideration).

12. Estimate the time required to face a job 20 cm lomg and 10 cm wide with the help of milling cutter of 10cm dia, having 8 teeth and revolving at 80 rpm. The feed per tooth should not exceed 0.125 mm. assume that the width of the cutter is sufficient to mill the whole of the job at a time.

13. A 20 X 7.5 cm CI surface is to be faced on milling machine with a cutter having a diameter of 125 cm and 20 teeth. If the cutting speed and feed are 50m/min and 4.5 cm/min respectively, determine the milling time, rpm of the cutter and feed per tooth.

14. A slot is tobe made on a milling machine with the help of a cutter, revolving at 100 rpm. Finf the time required to prepare the slot in two cuts, if it is 15 cm deep and 20 cm long with a cutter of 10 cm dia. Assume feed as 0.5 mm/rev.

15. A slot of length 25 cm and of depth 3.375 cm is to be milled by 12.5 cm diameter cutter. What is the total table travel to complete the cut? Also Estimate the time required for milling the slot when the cutter is turning at 191 rpm with an average feed of 0.0125 cm and having 16 teeth.

16. Estimate the time required to cut 60 teeth on a gear blank of 50 mm thick, with a feed of 30 mm/min. take added table travel as 10 mm and setup time as 10 minutes.

17. Estimate the time taken to prepare a square prism on a milling machine from a round block 90 mm length and 40 mm dia. Feed 25mm/min. setup and indexing time is 15 minutes.

18. Determine the time taken for shaping a cast iron block 50 cm long and 30cm wide in a single cut. Feed is taken to be 0.8 mm/ stroke and cutting speed 1 m/min.

19. Estimate the time required for planning a piece of mild steel75 cm long and 30 cm wide on a planning machine. The cutting speed on the tool is 10 m/min and feed 0.0782 cm/ stroke.

20. A machine bed is to be planed in two cuts on a planning machine. It takes 10 seconds in forward stroke and 7 seconds in return stroke. Estimate out the time required to plane the bed of width 40cm. assume the feed as 1mm/stroke.

21. Estimate the time required for doing rough grinding of a 16cm long steel shaft to reduce its dia from 4.2 to 4 cm in a grinding wheel of 12 cm face width. Assume cutting speed as 16.5m/min and depth of cut as 0.25mm.

22. The top of a cast iron table of size 40 X 9 cm is to be ground by a wheel having 2 cm face width. If the feed is $1/4^{th}$ of the width of the wheel and the table moves 9m in one minute. Estimate out the time required for grinding in two cuts.

23. Estimate out the machining time to complete the job as shown in figure. From the basic raw material of 50 mm dia and 100 mm length. Cutting speed for turning 30 m/min, feed=1mm/rev, depth of cut=2.5mm. cutting speed for thread cutting=9 m/min. cutting speed for drilling=30m/min and feed for drilling=0.2 mm/rev.
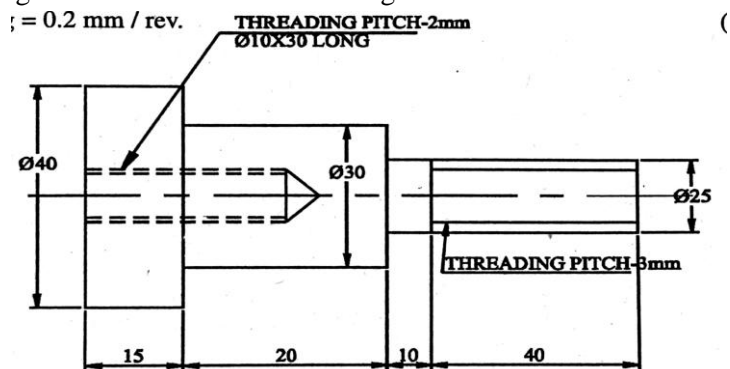
24. Estimate the time taken to prepare a job according to the dimensions shown in figure. From a bar 3.5 cm dia and 6 cm long. Assume following data.

Cutting speed for turning and boring	= 20m/min
Cutting speed for drilling	=30m/min
Feed for turning and boring	= 0.2mm/rev
Feed for drilling	= 23 mm/rev
Depth of cut not to exceed	= 3mm.
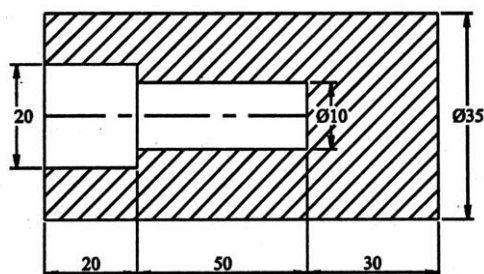
25. It is desired to manufacture 100 bolts/day from MS bar of length 10 cm and diameter 30 mm. bolt has the following dimensions: dia of shank=1.2cm, dia of head =20 mm, thickness of head=10mm, lengt of bolt (face to face) = 10 cm. length of threaded portion = 3cm. assume

i) feed for turning   =0.2cm/rev
ii) cutting speed for turning   =20m/min
iii) cutting speed for threading   = 10m/min
iv) depth of cut   = max. of 3mm
v) pitch of threads   = 2.5 mm
vi) no. of cuts required for threading =6

Determine the machining time for 100 bolts if the operator is paid at the rate of Rs. 4.25 per hour. Estimate the labour charges considering other allowance for fatigue etc as 100%.

CO4: Ability to estimate the various welding & sheet metal components

UNDERSTANDING

1. Explain the any five sheet metal operations.
2. Explain the types of sheet metal joints.
3. Explain types of welding.
4. Explain the types of welding costs.
5. Explain the factors affecting the welding cost.

APPLICATION

Estimation in welding shop

1. Estimate the time required for making an open tank of size 50x50x50 cm by gas welding. Size of sheet used is 50x50x0.3 cm welding is to be done on both sides. Assume fatigue allowance to be 10% and welding speed outside as 6m/hr and inside 5m/hr.

2. Estimate the material cost for linear welding of two flat pieces of MS 45cm x 6 cm x 1 cm size at an angle of 90° by gas welding on both sides. Neglect edge preparation cost and assume i) cost of oxygen   =Rs 10/m^3

                      ii) cost of acetylene   =Rs 60/m^3
                      iii) density of filler metal=7 gms/cc
                      iv) cost of filler metal   = Rs 12/kg
                      from the table for 10mm thick plates
                      i) O_2 consumption =0.7 m^3/hr
                      ii) C_2H_2 consumption= 5mm
                      iii) filler rod dia   = 5mm
                      iv) length of filler rod required=4.5 m/m of welding
                      v)welding time   = 30 min/m of welding

3. Estimate the welding material cost for making a rectangular frame for a gate of 2m x 1m from angle iron size 30mm x 30mm x 5mm. assume the following data:
                 i) oxygen consumption=0.4 cu.m/hr which is available at Rs. 50/cu.m
                 ii) acetylene consumption = 0.4 cu.m/hr which is available at Rs.50/cu.m
                 iii) welding speed   = 4 m/hr
                 iv) length of filler rod of dia 2.5mm= 3.4 m/m of welding
                 v) filler rod material cost   = Rs.13/kg
                 vi) welding is to be done on both sides

4. A cylinder boiler drum 3m x 1m dia is to be made from 1.5 thick MS plates. Both the ends are closed by welding circular plates to the drum. The cylindrical portion is welded along the longitudinal seam both inside and outside. Circular plates are welded only on outside. Determine the cost of electric arc welding using the following data:
                 i) rate of welding 2m/hr on inside & 2.5 m/hr outside

ii) length of electrode required 2m/m of welding

iii) cost of electrode Rs. 6/- per meter

iv) power consumption 5 kwh per metre of weld

v) power charges Rs 2/- per unit

vi) labour charges Rs 10/hr

vii) overhead charges 200% of prime cost

viii) discarded electrodes -5%

ix) fatigue 7 setting up time -5% of welding time

5. Two 1m long MS plates of 10mm thickness are to be welded by a lap joint with the help of a 6 mm electrode. Determine the cost of welding
   a. Current used   :250 amp
   b. Voltage   : 30 V
   c. Welding speed   : 10m/hr
   d. Electrode used   : 0.4 kg/m of welding
   e. Labour charges Rs 1/ hr
   f. Power charges Rs 0.20/kwh

   Cost of electrode Rs 5/kg

6. A container open on one side (top side) of size 0.5x0.5x1 m height is to be made from 5mm thick plate. Take the density of plate metal as 8 gms/cc. the joints one to be welded. Estimate the cost of the container from the following data
   Cost of plate   =Rs. 12 per kg
   Sheet metal scrap   = 5% of the material
   Cost of labour   =10% of material cost
   Cost of welding material=Rs.30 per metre of weld

7. An open water tank 1mx1mx2.5m height is to be favricated from MS plates of 2.5cm thick. Estimate the cost of the tank from the following data.
   Density of MS   =8gm/sec
   Cost of MS plate   =Rs. 6/kg
   Cost of fabrication   =25% of material cost
   Cost of welding   =Rs. 0.25 per cm length
   Factory overhead charges= 30% of prime cost
   Sales overheads   =20% of manufacturing cost
   Profit   =25% of total cost.

8. A mild steel vessel 1m in dia and 2m in length is to be fabricated by using MS sheets of 5mm thick by welding on both sides. Sheets are available in sizes 1mX3m. estimate how many number of sheets required and the total quantity of the material required. Also Estimate, welding length, length of electrode, time required for welding for welding and power consumption. Use following data: density of MS=7.8 g/cc, rate of welding=1.5m/hour. Length of electrode=1.5m/m of weld, power consumption=4kwh per m of weld. Illustrate clearly with appropriate sheet layout to support your estimation.

9. Estimate the cost of metal sheet for preparing a funnel as show in figure. Assume the wastage of metal as 10% and cost of sheet as Rs.50/m^3.
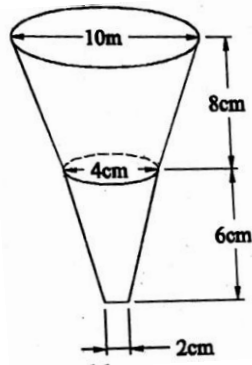
10. Estimate the cost of metal sheet for preparing a funnel as shown in figure. Assume the stage of metal as 10% and cost of the sheet as Rs. 20/m^2. all dimensions are in mm.
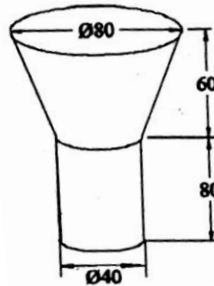
11. A cylinder drums of size 2.75 m height and 1.5m mean dia are to be fabricated from sheet of 5mm thickness by grooved seam joint and both the ends should be closed by sheet with single seam joint. Determine the material cost, if sheet is available at Rs. 2000/ m^2.

CO5: Ability to estimate the various forging & foundry shop components.

UNDERSTANDING
1. Explain the Cost terminology associated with forging shop.
2. Explain the procedure of calculating material cost of a product for forging shop
3. Explain the types of forging.
4. Explain the Procedure for estimating forging cost.
5. Explain the forging losses to be considered while estimating.
6. Explain the pattern allowances.
7. Explain the procedure for calculating material cost of a product for foundry shop.
8. Explain the procedure for estimating cost of pattern making.

APPLICATION

1. Prepare a hexagonal bolt 15mm diameter and 25cm length from a bar stock of 1.8 cm diameter. Determine the length of the bar stock required and also give the sequence of operations for forging the above bolt.
2. Estimate the size of stock and weight of material required to forge 100 MS bolts as shown in figure. The bar stock diameter is 3 cm.
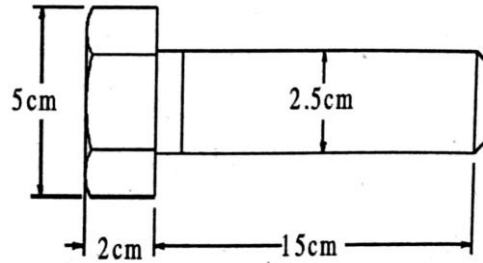
3. A hexagonal bolt 25mm dia and 200 mm length is to be forged from a bar stock of 30 mm dia. Determine the length of bar stock required if the total material loss is 15% of the net weight of the bolt. Hexagonal bolt head has 20 mm thickness.

4. Determine the gross weight of the MS bolt if it is produced in a lot of 5000. If steel weighs 7.9 gm/cm^3 and the method is upsetting. Also Determine the length of the bar required. Take spoilage loss as 10% of net weight, loss of scaling to be allowed as 5% of each component. The bolt is square headed bolt with head 40 square and height 15 mm, shank dia is 20mm, length 55mm. all dimensions are in mm.

5. Determine the length of 10 mm dia rod required to forge a ring of 50 mm inner dia. A scale loss of 5%.

6. A square bar of 3cm side and 25 cm length is to be converted by hand forging into a bar of hexagonal section having each side equal to 1.5cm. Determine the length of hexagonal bar produced; consider scale loss to be 7% of the total volume.

7. Estimate the length and weight of 1 cm dia stock required to hand forge 200 rivets of dimensions given in figure. Assume density of material as 8 gm/cc.
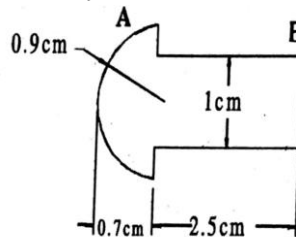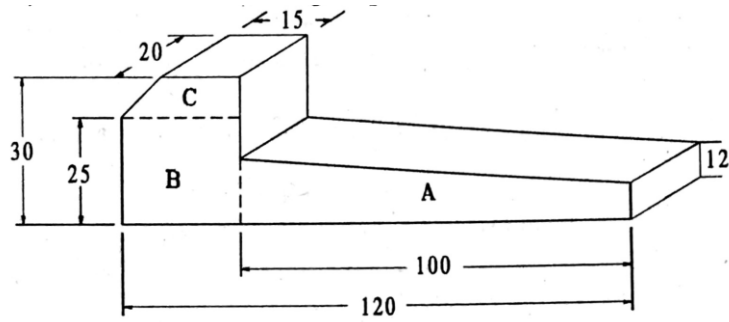

8. It is required to make a key of dimensions given figure. From a rod of 20mm dia. Determine the length of rod required on forging.
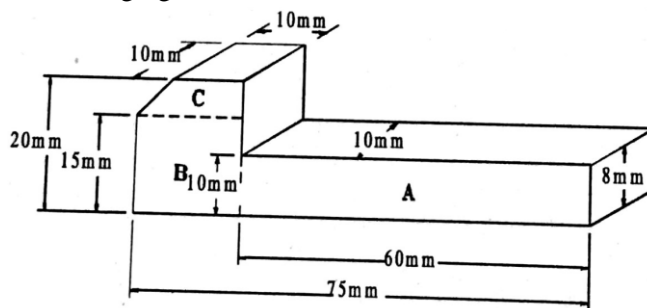

9. 300 pieces of gib headed key shown in figure are to be drop forged from a 4cm diameter bar. Determine the cost of material if
      i) material cost is Rs. 50/- per metre
      ii) scale loss 8%
      iii) shear loss as 3 mm length/piece

10. A finished drawing of a CI flanged pipe is given in figure. Your are required to prepare a wooden pattern in the pattern making shop. Estimate the quantity of wood required for manufacturing the pattern. Also estimate the cost of pattern if:

        a) wood is available at the rate of rs.2800 $1m^3$

        b) pattern maker is available at the rate of Rs 80/ day and takes 6 hrs in preparing the pattern

        c) overhead charges are 20% of material cost.
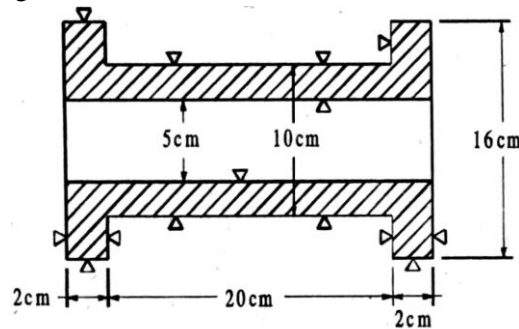
11. Estimate the cost of 2000 CI pulleys as shown in figure. Its surfaces are to be machines after casting. The pattern is supplied by the customer itself. Following data can be used:

        Cost of metal   = Rs.5/kg

        Moulds prepared by each worker/day=20

        Melting charges   = 20% of metal cost

        Machining allowance on each side may be taken as 2mm

        Wages of each moulder =Rs. 16/day

        Density of CI   = 7.2 gm/cc

        Overhead charges   = 25% of metal cost.
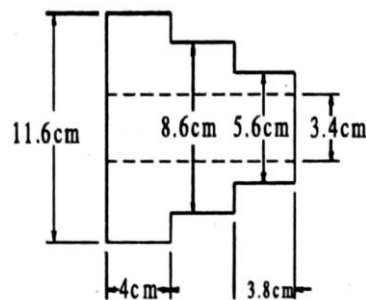
12. A manufacturer is willing to undertake the casting of 100 CI wheels shown in figure. Estimate the selling price of each wheel assuming the following:

        i) cost of pattern   =Rs.40

        ii) process scrap   = 10% of net weight

        iii) scrap return value   = Rs.2.25/kg

        iv) cost if CI   = Rs.5/kg

        v)administrative overgeads= Rs.2/piece

vi) selling overheads   = 25% of production cost
vii) profit   = 15% of total cost

unit operation	time	Rate/hour	Shop overheads
moulding	10 min	Rs. 3	Rs. 10/hr
pouring	6 min	Rs.2.50	Rs.8/hr
shot blasting	4min	Rs. 4.50	Rs.3.50/hr
fettling	5 min	Rs. 2.50	Rs. 3.00/hr
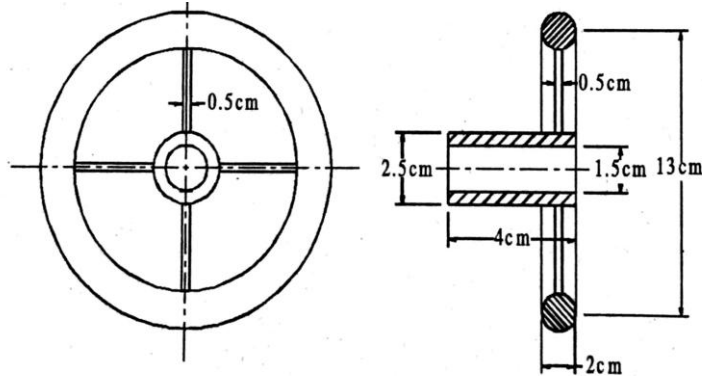
UNDERSTANDING
1. Explain the process costing.
2. Explain the characteristics of process costing.
3. List disadvantages and advantages of process costing
4. Explain the principles of process costing
5. Differentiate between job costing and process costing
6. Explain the procedure of process costing
7. Define a) nominal wages b) real wages c) fair wages d) minimum wages
8. Explain the concept of incentives
9. Explain different types of budget
10. Explain briefly: book value-Net Present Value-Work in progress- Gross Domestic Product (GDP)-balance sheet
11. Explain manual tendering
12. Explain E-tendering

	Course Title: **COMPUTER INTEGRATED MANUFACTURING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME62T**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Core**

Prerequisites: Knowledge of basic mathematics and Applied Science, Engineering Graphics

Course Objectives:

The use of conventional machines is decreasing day by day. Evolution of information Technology, variety of manufacturing concepts with zero lead time demand and quality consciousness has supported fast adaption of Computer Aided Manufacturing.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand the principle of automation	*R/U/A*	2	**09**
CO2	Compare NC and CNC machines	*R/U/A*	2	**08**
CO3	Know the constructional features of CNC machines.	*R/U/A*	2	**10**
CO4	Construct part programmes using ISO format for given simple components	*R/U/A/An*	2	**12**
CO5	Develop an FMS (Flexible Manufacturing System) layout for given simple part family, using group technology concepts and familiarize with computer aided process planning	*R/U/A*	2	**07**
CO6	Recognize use of robotics, in the field of manufacturing.	*R/U/A*	2	**06**
		Total sessions		**52**

Legend: R: Remember U: Understand A: Application An: Analysis

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
CIM	0	3	0	0	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE/

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A/An		
1	**Introduction to CIM& Automation**	09	5	10	5	20	13.79
2	**NC &CNC machines.**	08	5	5	5	15	10.34
3	**Constructional features of CNC machines.**	10	10	15	10	35	24.13
4	**CNC Part programming**	12	5	15	20	40	27.58
5	**Computer aided manufacturing**	07	5	5	10	20	13.79
6	**Robotics**	06	5	5	5	15	10.34
	Total	52	35	55	55	145	100

Legend: R; Remember, U: Understand A: Application An: Analysis

Directorate Of Technical Education   Karnataka StateMECH   15ME62T

UNIT I: INTRODUCTION TO CIM & AUTOMATION   09 Hrs

CIM – definition, scope and elements of CIM system-benefits, Production system facilities – low-medium-high-Manufacturing support systems-Automation in production systems-Automated manufacturing systems-Computerized Manufacturing Support Systems-Reasons for Automating, Automation principles and strategies-USA Principle-Ten Strategies for Automation and Production Systems, Automation –definition- Basic elements of an automated system - Levels of automation

UNIT II: NC AND CNC MACHINES   08 Hrs

Fundamentals of NC Technology- Basic Components of an NC System- NC Coordinate Systems- Motion Control Systems, Applications of NC- Machine Tool Applications- Other NC Applications- Advantages and Disadvantages of NC, Computer Numerical Control-Features of CNC- The Machine Control Unit for CNC- CNC Software, CNC Applications-Advantages and Disadvantages of CNC, DNC- Direct Numerical Control- Distributed Numerical Control

UNTIII: CONSTRUCTION OF CNC MACHINES   10Hrs

Construction of CNC machines-Machine structure- Static load-Dynamic load-Thermal load, Guide ways-Friction guide ways-V guide ways-Flat &dovetail guide ways-Cylindrical guide ways-Anti frictional linear motion guide ways, Feed drives-Servomotors-Mechanical transmission system, Spindle and spindle bearings-Hydrodynamic bearings-Hydrostatic bearings-Antifriction bearings, Measuring systems- direct & indirect measuring systems, Gauging, Tool monitoring-direct & Indirect monitoring, Automatic tool changer (ATC)-Automatic pallet changer (APC)

UNITIV: CNC PART PROGRAMMING   12 Hrs

Introduction to Part Programming-Coordinate system-Dimensioning-Axes & motion nomenclature Definition and importance of various positions like machine zero, home position, and work piece zero, CNC part programming- Structure of part programme-Word addressed format-Preparatory function(G)-Miscellaneous function(M)- Tool compensation-Subroutines (Macros)(L)-Canned cycles-Mirror image, Simple programme on Milling and Turning operations

UNIT V: GROUP TECHNOLOGY AND CAPP   07 Hrs

Group technology-Definition-Advantages and limitations of GT-Part family formation-Classification and coding-Opitz coding system, Applications & benefits of GT, Cellular manufacturing-Machining cell designs-Machining cell planning, Computer aided process planning-Approaches to CAPP-Implementation techniques-Essential elements in a retrieval type CAPP system-Essential elements in a generative CAPP system, Flexible manufacturing system-Scope of FMS-FMS compared to other types of manufacturing approaches-Types of FMS-Benefits of FMS-Major elements of FMS

UNIT VI: ROBOTICS   06Hrs

Introduction-definition of robot-Elements of a robotic system-Need for using robots-Types of robots-Classification of robots based on mechanical configuration-Gantry robot-SCARA robot-Freedom of motion, End effectors-grippers & tools, Drive systems, Control systems,

Performance capabilities-specifications-key feature, Programming robots-Programming methods, Applications of industrial robot.

TEXT BOOKS AND REFERENCE

S. No.	Title of Book	Author	Publication	Reference unit
1	Automation, Production Systems, and Computer-Aided Manufacturing	by Mikell P. Groover	Prentice-Hall International publication	**Introduction to CIM & Automation** **NC and CNC machines**
2	Mechatronics	HMT limited	McGraw Hill Education	**Construction of CNC machines And**
3	CAD/CAM Principles and Applications	P N Rao	McGraw Hill Education	**CNC part programming. Group technology and CAPP**
5	CAD/CAM/CIM	P. Radhakrishnan, S. Subramanyan, V. Raju	New Age International Publishers	**Group technology and CAPP**
6	CNC Machines.	Pabla B.S., Adithan M.	New Age International, New Delhi,2014(reprint)	**Construction of CNC machines**
7	Computer Numerical Control-Turning and Machining centers.	Quesada Robert	Prentice Hall 2014	**CNC part programming**
8	CAD/CAM.	Sareen Kuldeep	S.Chand 2012.	**Group technology**
9	INDUSTRIAL ROBOTICS	Groover	McGraw Hill Education	**Robotics**

LIST OF SOFTWARES/ LEARNING WEBSITES:

i. http://www.nptel.ac.in

ii. http://www.youtube.com/watch?v=M3eX2PKM1RI

iii. http://www.youtube.com/watch?v=EHQ4QIDqENI&list=PLBkqkLQO2nAt5MNLo

iv. http://www.youtube.com/watch?v=hJFLcvtiNQ I

v. http://www.youtube.com/watch?v=BIM1AyxfYkw .

vi. http://www.mtabindia.com

vii. http://www.swansoftcncsimulator.com

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	**Introduction to CIM& Automation**	Videos, Presentations, Demonstration
2	**CNC machines.**	Videos, Presentations, Industrial Visits, Demonstration,
3	**Constructional features of CNC machines.**	Videos, Presentations, Industrial Visits, Demonstration,
4	**CNC Part programming**	Simulation software's, actual practice on

			CNC machines, Demonstration,
5	**Computer aided manufacturing**		Videos, Presentations, Industrial Visits, Demonstration,
6	**Robotics**		Videos, Presentations, Industrial Visits, Demonstration,

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Visit nearby industry having CNC machines. List and Recall important features of them. submit handwritten report of 500 words
2	Construct specifications of various types of CNC machines with images and names of manufacturers.
3	Download images and videos of CNC machines and its parts. Construct one VCD/DVD in a batch and submit them
4	Download free simulation software's available on website and practice for part programming.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

	RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of VI sem 10-11 Am	VISEM	**COMPUTER INTEGRATED MANUFACTURING** **15ME62T**	20
	Year: 2016-17	Course code:15ME62T	

Name of Course coordinator :   Units:1,2 CO: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Compare between fixed, programmable and flexible automation system OR Explain the general configuration of Distributed Numerical Control system	05	A	1	2
2	List Ten Strategies for Automation and Production Systems	05	R	1	2
3	Compare between Point-to-Point Versus Continuous Path Control system OR Compare between Absolute Versus Incremental Positioning	05	A	2	2
4	Explain about Interpolation Methods	05	U	2	2

MODEL QUESTION PAPER

VI- Semester Diploma Examination
Course Title: **COMPUTER INTEGRATED MANUFACTURING**

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX** from Part A and any **SEVEN** from Part B

PART-A   6x5=30 marks

1. Indentify the benefits of CIM
2. Explain flat and dovetail guide ways
3. Compare between direct and indirect measuring system
4. Compare between fixed, programmable and flexible automation system
5. Compare between Point-to-Point Versus Continuous Path Control system
6. Define cellular manufacturing and Explain its relevance in modern manufacturing
7. List out the key features and specifications required for improving the performance capability of a robot
8. Compare between tool length compensation and tool radius compensation
9. Identify the applications of group technology

PART-B   7x10=70 marks

10. List the advantages and dis-advantages of CNC machines
11. Make use of sketch explain the working of   Antifriction bearings
12. Explain the basic design factors involved in the design of a machine structure
13. Construct a part programme for the following component using sub routine shown in figure
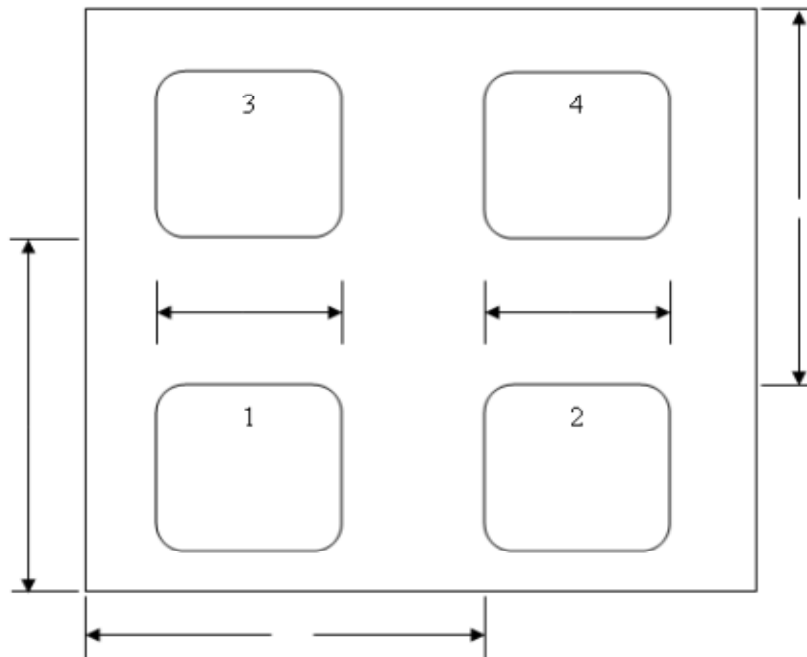
14. Construct a part programme for the following component using sub routine shown in figure

15. Explain about the Opitz coding system generally used in group technology
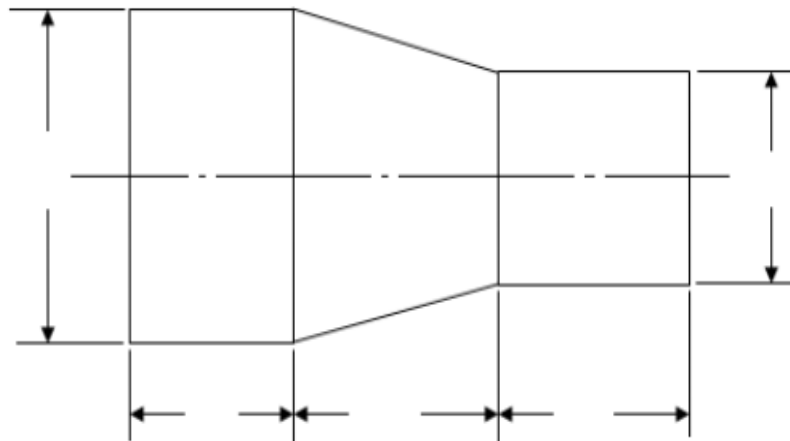16. Explain the methodology to be followed for developing a generative type of computer aided process planning system
17. Explain with sketch the SCARA robot
18. Explain with sketch a typical machine tool with an automatic pallet changer (APC)
19. Explain tool monitoring and tool gauging system
20. Explain programming of robots

****

MODEL QUESTION BANK

Diploma in Mechanical Engineering
VI Semester
Course title: COMPUTER INTEGRATED MANUFACTURING

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO1: Understand the principle of automation

REMEMBERING

1. Define CIM and mention its needs.
2. Recall the reasons for automation

3. Define automation and mention its needs
4. List Ten Strategies for Automation and Production Systems

5. Explain Production system facilities
6. Explain low quantity production
7. Explain medium quantity production
8. Explain high quantity production
9. Explain automation in production systems
10. Explain Automated manufacturing systems
11. Explain manufacturing support systems
12. Explain computerized manufacturing support systems
13. Explain USA principle
14. Explain control system
15. Explain programme of instructions
16. Explain about the main elements of CIM system
17. Explain the information-processing cycle in a typical manufacturing firm.
18. Compare between fixed, programmable and flexible automation system
19. Explain about basic elements of an automated system
20. Explain about the five levels of automation

APPLICATION

21. Indentify the benefits of CIM
22. Identify the scope of CIM

CO2: Compare NC and CNC machines

REMEMBERING
1. Recall the NC Interpolation Methods for Continuous Path Control
2. List Machine Tool Applications of NC system
3. List the advantages and disadvantages of NC system
4. Define Computer Numerical Control system and Recall its needs in manufacturing
5. List the Features of CNC
6. List the three types of CNC Software
7. List the advantages and disadvantages of CNC system

UNDERSTANDING

8. Explain three basic components of an NC System
9. Explain NC Coordinate Systems
10. Explain about Interpolation Methods
11. Explain Direct Numerical Control system
12. Explain Distributed Numerical Control system
13. Illustrate the general configuration of Direct Numerical Control system
14. Illustrate the general configuration of Distributed Numerical Control system
15. Compare between Point-to-Point Versus Continuous Path Control system

16. Compare between Absolute Versus Incremental Positioning.
17. Compare between linear and circular interpolation methods
18. Explain the configuration of CNC machine control unit.

APPLICATION

1. Choose the Applications of CNC system
2. Choose the Applications of NC system

CO3: Know the constructional features of CNC machines

REMEMBERING

1. List the important parts and aspects of CNC machines to be considered in their designing.
2. List the important factors to be considered while designing guide ways
3. Recall the necessity of antifriction linear motion guide ways used in CNC machine tools
4. List commonly used feed drive motors for CNC machines and Explain direct current servo motors
5. List two types of mechanical transmission system and Recall the main criterion to be considered in the design of a mechanical transmission system
6. List the various types of spindle bearings used in the design of a spindle for machine tools.
7. List the methods of measuring system
8. List the requirements for tool changing activity
9. List the requirements to operate the automatic tool changer

UNDERSTANDING

10. Explain static load, dynamic load and thermal load in machine structure
11. Explain frictional guide ways
12. Explain Vee guide ways
13. Explain flat and dovetail guide ways
14. Explain cylindrical guide ways
15. Explain the principle of hydrodynamic bearings
16. Explain the principle of hydrostatic bearings
17. Explain the principle of Antifriction bearings
18. Explain gauging in CNC machines
19. Explain tool monitoring system
20. Explain tool magazines
21. Explain the basic design factors involved in the design of a machine structure
22. Explain about elements used to convert the rotary motion to a linear motion
23. Explain about torque transmission elements

24. Compare between direct and indirect measuring system
25. Compare between direct and indirect monitoring system
26. Explain about tool changing

27. Make use of sketch explain a typical machine tool with an automatic pallet changer (APC)
28. Identify the function of measuring systems which are used in CNC machines
29. Choose the functions of guide ways

CO4: Construct part programmes using ISO format for given simple components

REMEMBERING

1. Define CNC part programming
2. Choose the function of automatic tool changers in CNC machine tools

UNDERSTANDING

3. Explain the factors to be considered while writing the CNC part program.
4. Explain the co-ordinate system and methods of dimensioning.
5. Explain the various positions like machine zero, home position, and work piece zero.
6. Explain word addressed format.
7. Explain commonly used preparatory and miscellaneous functions for turning.
8. Explain commonly used preparatory and miscellaneous functions for milling
9. Illustrate the circular interpolation using interpolation parameters
10. Illustrate the circular interpolation by specifying the radius
11. Compare between tool length compensation and tool radius compensation
12. Illustrate subroutines (macros) (L)
13. Illustrate canned cycles using any one code from (G81-G89)
14. Illustrate mirror image
15. Explain axes and motion nomenclature.

APPLICATION/ANALYSIS
16. Make use of block diagram write the structure of part program.
17. Construct Simple programme on Milling and Turning operations
18. Construct a part programme for the following component shown in figure
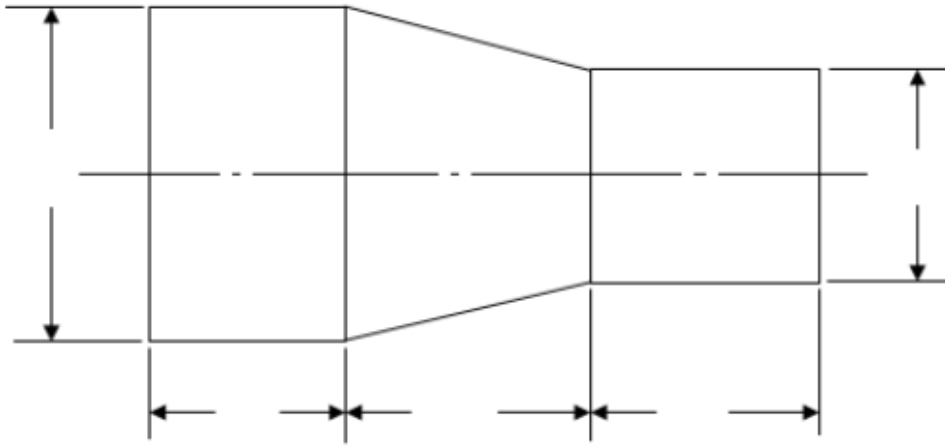
18. Construct a part programme for the following component shown in figure
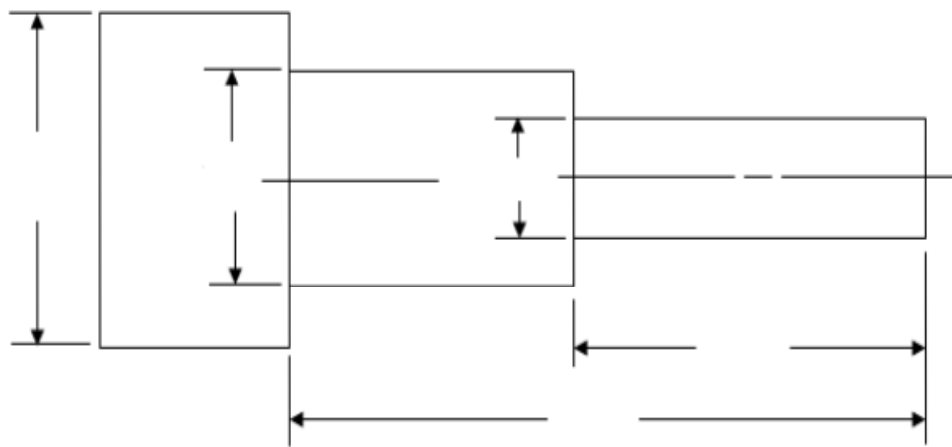
19. Construct a part programme for the following component shown in figure
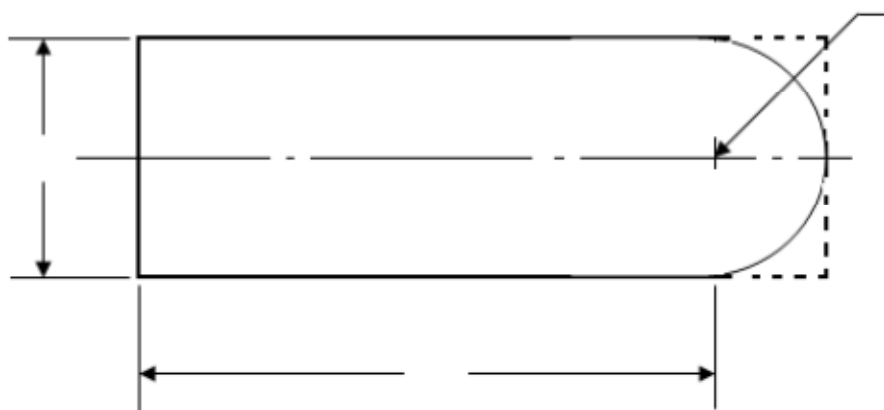
20. Construct a part programme for the following component shown in figure
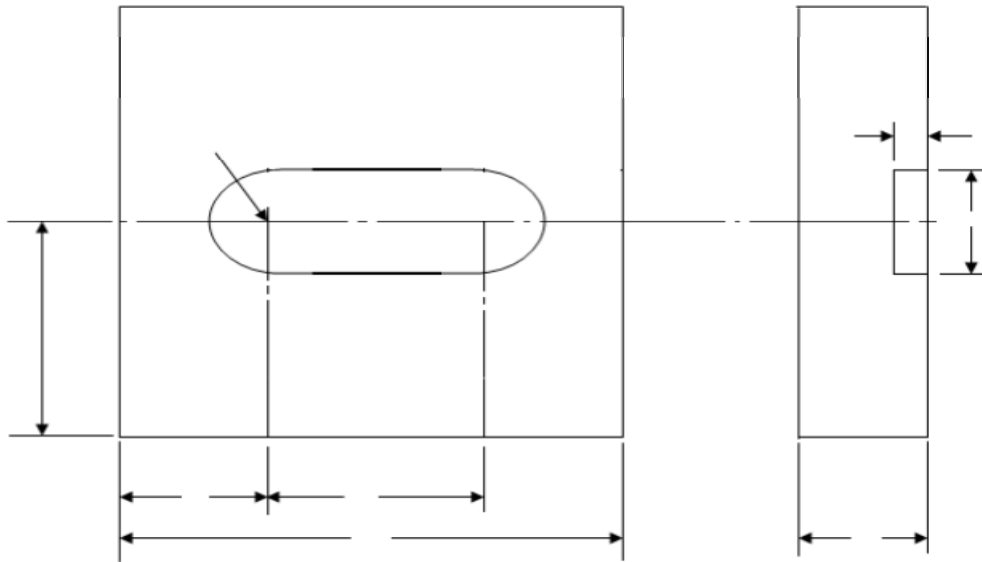
21. Construct a part programme for the following component shown in figure

22. Construct a part programme for the following component shown in figure

23. Construct a part programme for the following component shown in figure
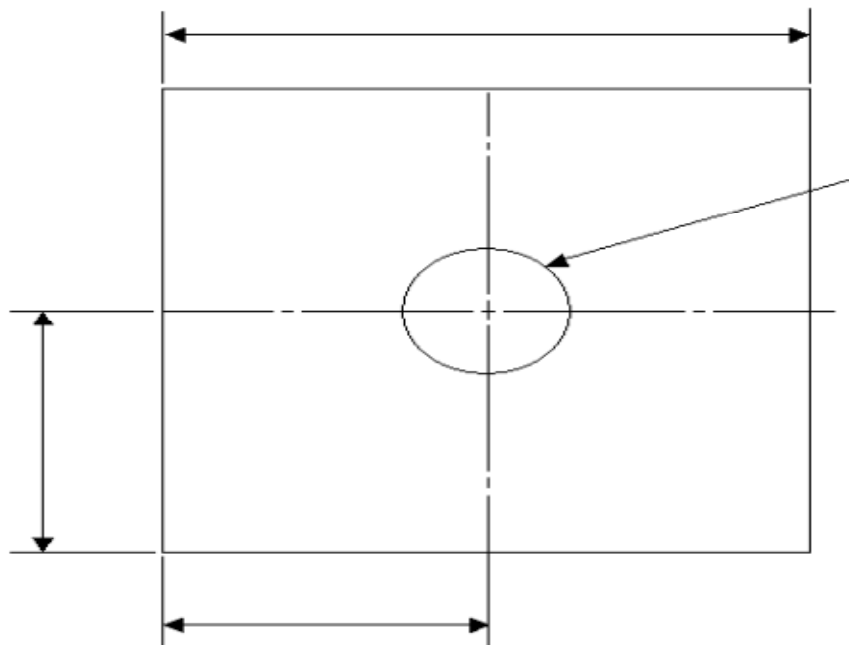
24. Construct a part programme for the following component shown in figure
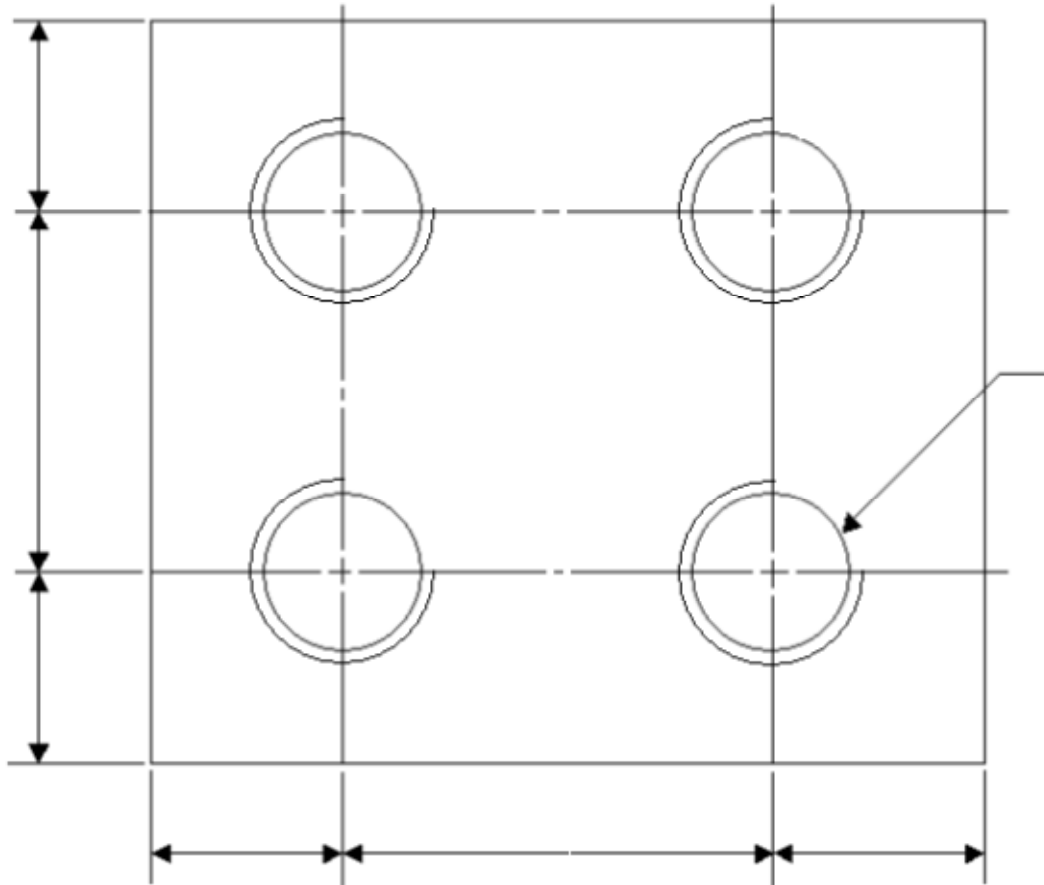
25. Construct a part programme for the following component using do-loops shown in figure
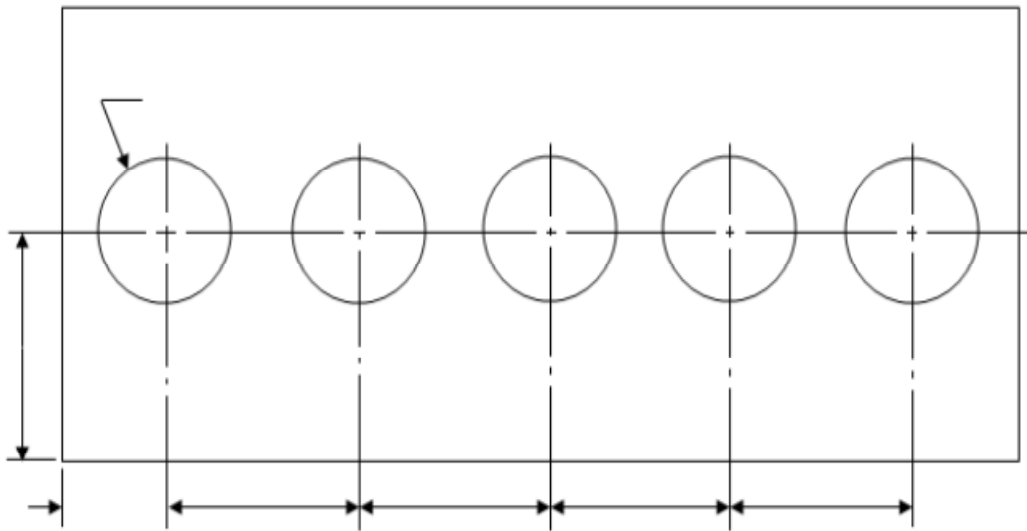
26. Construct a part programme for the following component using sub routine shown in figure
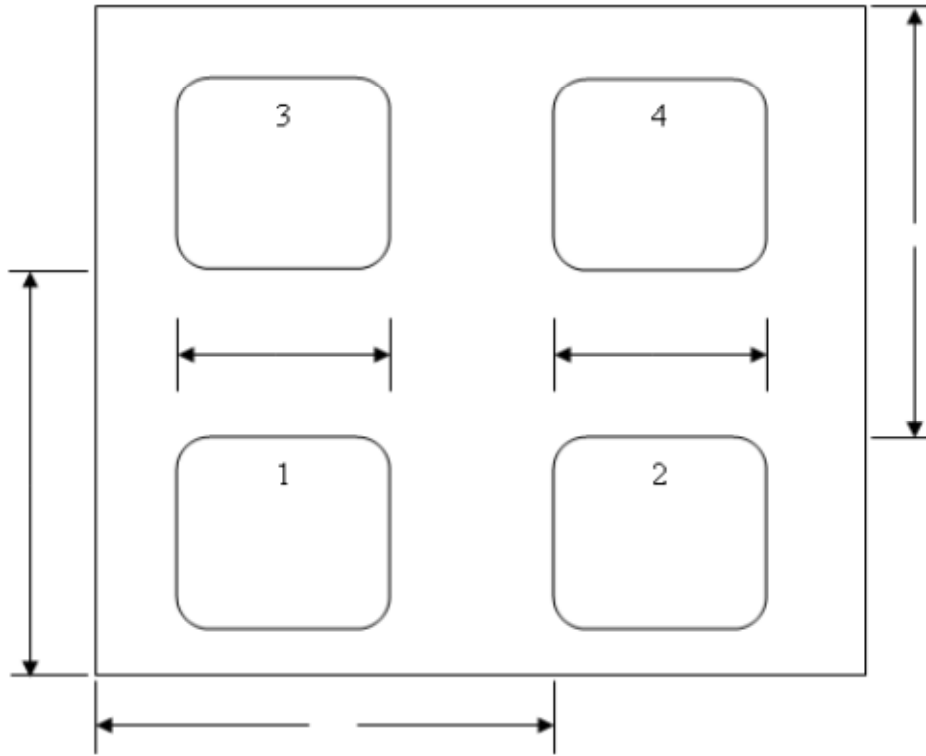
REMEMBERING

1. List and explain the different methods available for forming groups in group technology
2. List the functions of classification and coding system
3. List the types of coding systems
4. List the applications of group technology
5. Define cellular manufacturing and Explain its relevance in modern manufacturing
6. List and explain the machining cell designs

UNDERSTANDING

7. Explain the importance of group technology in present manufacturing scenario
8. Explain group technology
9. Explain about the Opitz coding system generally used in group technology
10. Explain the needs for computer aided process planning
11. Explain the retrieval type of computer aided process planning method
12. Explain the generative type of computer aided process planning method
13. Explain the methodology to be followed for developing a retrieval type of computer aided process planning system
14. Explain the methodology to be followed for developing a generative type of computer aided process planning system
15. Explain the need for FMS
16. Explain the importance of material handling system in FMS

17. Explain the types of materials handling devices used in a FMS
18. Compare between retrieval type and generative type of computer aided process planning
19. Compare FMS to other types of manufacturing approaches

APPLICATION

20. Identify the benefits of group technology
21. Choose the major elements of FMS
22. Identify the benefits of FMS
23. Identify the advantages and limitations of group technology

CO6: Recognize use of robotics, in the field of manufacturing.

REMEMBERING

1. Define robot and explain its needs in computer integrated manufacturing
2. List the significant advantages of using a robot in a computer integrated manufacturing
3. List the different types of robots
4. Recall the different types of drive systems used in robots.
5. Recall the different types of end effectors
6. Recall and explain the different types of control systems used in robots
7. List out the key features and specifications required for improving the performance capability of a robot

UNDERSTANDING

8. Explain the functions of mechanical components in robotic system
9. Explain rectangular co-ordinate robots
10. Explain cylindrical co-ordinate robots
11. Explain spherical co-ordinate robots
12. Explain revolute co-ordinate robots
13. Explain types of grippers used in industrial robot
14. Explain tools used in industrial robots as a end effectors
15. Explain programming of robots
16. Explain the methods used for program the robots
17. Explain the classifications of robots based on mechanical configuration
18. Compare between a SCARA and a gantry robot
19. Explain about six degrees of freedom in order to get the motions in robots.
20. Explain about the major functions of a control system used in robots
21. Explain about applications of industrial robot

APPLICATION
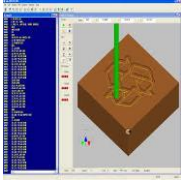
1. Make use of sketch explain the Gantry robot

2. Make use of sketch explain the SCARA robot
3. Choose the elements of a robotic system
4. Identify the important benefits of robots in CIM
5. Choose the functions of robot in computer integrated manufacturing

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **CNC LAB**	
Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME64P**
Type of Course: **Tutorial and practice**	Credit :**03**	Core/ Elective: **Core(practice)**
CIE:25 Marks		SEE:50 Marks

Prerequisites: Learning concepts of Computer Integrated manufacturing

Course Objectives:

1. By undergoing this lab the students will learn to use the CNC machines efficiently for manufacturing desired products and knowledge of programming and use of CNC tooling

Course Out comes

Students *On successful completion of the course, the students will be able to attain CO:*

	Course Outcome	CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Appreciate the importance of CNC lathe and CNC Milling machines	*U/A*	1-10	2,3,4	**18**
CO2	Understand the codes (G-code and M-Code) used in CNC machines for programming	*U/A*	1-10	2,3,4	**15**
CO3	Develop Programming skills and crate an component for required drawing, Simulate the prepared part programme using available simulation software's. And Prepare the parts on CNC	*U/A*	1-10	2,3,4	**27**
Total sessions					**78**

Legend: U: Understand   A: application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
CNC LAB	0	3	3	3	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Directorate Of Technical Education, Karnataka State   **15ME64P**   **MECH. ENGG**

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
PART A. CNC turning centre part programming		
Students would:		
a. Sketch each part with dimensions.		
b. Prepare CNC part programme using G and M codes with ISO format.		
C. Show various zeros and tool path on part sketch with color codes and dimensions.		
d. Simulate the prepared part programme using available simulation software's.		
e. Prepare the parts on CNC		
1	Develop a part program for step turning and simulate	06
2	Develop a part program for taper turning and simulate	06
3.	Develop a part program for circular interpolation and simulate	06
4	Develop a part program for multiple turning operation and simulate	06
5	Develop a part program for thread cutting, grooving and simulate	06
6	Develop a part program for internal drills, boring and simulate	06
PART- B. CNC machining centre part programming		
Students would:		
a. Sketch each part with dimensions.		
b. Prepare CNC part programme using G and M codes with ISO format.		
C. Show various zeros and tool path on part sketch with color codes and dimensions.		
d. Simulate the prepared part programme using available simulation software's.		
e. Prepare the parts on CNC		
7	Develop a part program for grooving and simulate on CNC Milling	09
8	Develop a part program for drilling (canned cycle) and simulate	09
9	Develop a part program for mirroring with subroutines and simulate	12
10	Develop a part program for rectangular and circular pocketing and simulate	12
	TOTAL	**78**

TEXT BOOKS & REFERENCE

S. No.	Title of Book	Author	Publication
1	CNC Machines.	Pabla B.S., Adithan M.	New Age International, New Delhi,2014(reprint).
2	CAD/CAM: computer aided design and manufacturing.	Groover Mikell P, Zimmered W Emory	Prentice Hall 2014.
3	Computer Numerical Control-Turning and Machining centers.	Quesada Robert	Prentice Hall 2014.
4	CAD/CAM.	Sareen Kuldeep	S.Chand 2012.
5	Introduction to NC/CNC Machines.	Vishal S.	S.K.Kataria & Sons. 2012.
6	Computer Aided Manufacturing.	Rao P N, Tiwari N K, Kundra T	Tata McGraw Hill 2014.

SUGGESTED LEARNING RESOURCES

- http://www.nptel.ac.in
- http://www.youtube.com/watch?v=M3eX2PKM1RI
- http://www.youtube.com/watch?v=EHQ4QIDqENI&list=PLBkqkLQO2nAt5
- http://www.youtube.com/watch?v=hJFLcvtiNQI
- http://www.youtube.com/watch?v=BIM1AyxfYkw .
- http://www.mtabindia.com
- http://www.swansoftcncsimulator.com

SUGGESTED LIST OF STUDENT ACTIVITES

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. *Each student should conduct different activity and no repeating should occur*

1	Visit nearby industry having CNC machines. List and state important features of them with detail specifications and name of manufacturers.
2	Download free simulation software's available on website and practice for part programming
3	At least take two simple mechanical components likes step turned shaft, sleeve, muff measure the dimensions, prepare the sketch and develop part program, then simulate

Course Delivery:

The course will be delivered through specific instructional strategies detailed as below

S.N.	Unit Name	Strategies
1	Introduction.	Videos, Presentations, Demonstration.
2	CNC Turning & Machining Centers..	Videos, Presentations, Industrial Visits, Demonstration,
3	CNC part programming.	Simulation software, actual practice on CNC machines, Demonstration,

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	CIE (Continuous Internal Evaluation)	IA Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3
				Activity	05	Report	1,2,3
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3 Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

	RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the performed activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

Scheme of Valuation for End Examination

Serial no	Description		Marks	
1	**Part A – CNC Turning** **Writing**	10		**20**
	Execution	10		
1	**Part B – CNC Milling** **Writing**	10		**25**
	Execution	15		
3	**Viva**			**5**
			TOTAL	**50**
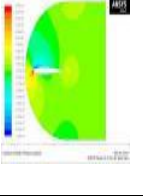
EQUIPMENT LIST: Quantity: 01 Each

Sr. No.	Resource with brief specification
1	CNC Turning Centre (Tutor or Productive)- Minimum diameter 25 mm, Length 120 mm with ATC. (Approximate)
2	CNC Machining Centre (Tutor or Productive)- X axis travel - 225 mm, Y axis travel - 150 mm, Z axis travel - 115 mm, With ATC.(Approximate)
3	Simulation software likes: CNC Simulator Pro, Swansoft CNC, etc.
4	Latest version of CAD/CAM integration software like MASTER CAM, NX CAM

	Course Title: **Computer Aided Analysis and Simulation lab**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: **15ME65P**
	Type of Course: **Tutorial and practice**	Credit **:03**	Core/ Elective: **Core(practice)**
CIE:25 Marks			SEE:50 Marks

Prerequisites: Learning concepts of strength of materials, machine design and Computer aided engineering.

Course Objectives:

To make students understand and learn about the analysis and simulation of simple mechanical parts through software and the solving techniques of various engineering problems.

Course Out comes

Students *On successful completion of the course, the students will be able to attain CO:*

	Course Outcome	CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Learn ANSYS- Analysis Software/Any analysis soft ware	*U/A*	1-8	2,3,4	**09**
CO2	Use the ANSYS software/Any open source analysis soft ware for solving various problems	*U/A*	1-8	2,3,4	**50**
CO3	Have a good grip on simulations of the models any of the analysis software	*U/A*	1-8	2,3,4	**19**
Total sessions					**78**

Legend: U: Understand   A: application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
CAS LAB	0	3	3	3	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the Cos which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

LIST OF GRADED PRACTICAL EXERCISES

The practical/Graded exercises should be properly designed and implemented with an attempt to develop different types of learning out comes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills.

Exercise No.	Practical/Exercise	Apprx. Hrs. Required
	ANALYSIS and SIMULATION USING ANSYS	
1	Introduction to computer aided analysis and simulation	06
2	Awareness about using ANSYS	02
3.	Familiarisations of using ANSYS	02
4.	Tutorial on Finite element analysis - Introduction-Element properties-one dimensional problems-beams and frames-three dimensional problems in stress analysis	10
5	**Stress Analysis of Bars of Constant Cross Section Area** 1. Determine the nodal displacement, stress in each element and reaction forces of bar subjected to a Tensile force. 2. Determine the nodal displacement, stress in each element and reaction forces of bar subjected to a Compression force.	06
6	**Stress Analysis of Bars of Tapered Cross Section Area** 1. Determine the nodal displacement, stress in each element and reaction forces of Taper bar subjected to a external loads.	06
7	**Stress Analysis of Bars Varying In Cross Section or Stepped Bars** 1. Determine the nodal displacement, stress in each element and reaction forces of Stepped bar subjected to a external loads.	10
8	**Stress analysis of Beams** 1. Draw the shear force and bending moment diagrams for the given Cantilever beam due to applied load. 2. Draw the shear force and bending moment diagrams for the given Simply supported beam due to central point load 3. Draw the shear force and bending moment diagrams for the given Simply supported beam due to UDL 4. Draw the shear force and bending moment diagrams for the given Simply supported beam due to applied load(one point loads, and UDL) 5. Draw the shear force and bending moment diagrams for the given Simply supported beam due to Uniformly varying load(UVL) 6. Draw the shear force and bending moment diagrams for the given Simply supported beam due to applied load(Several point loads,UVL)	30
9	**Stress Analysis of a Rectangular Plate with a circular Hole** 1. Determine the stress acting on a rectangular plate with a	06

	circular hole due to the applied external load		
		TOTAL	**78**

TEXT BOOKS & REFERENCE

S. No.	Title of Book	Author	Publication
1	ANSYS free software tutorial	Free soft ware (Student version)	https://www.google.co.in/search?biw=1024&bih=667&q=ansys+software+tutorial&sa=X&ved=0ahUKEwjm5o_MndHNAhUBsI8KHbRWDhUQ1QIIXygE

SUGGESTED LEARNING RESOURCES

- http://www.nptel.ac.in
- www.**ansys**.com/Student
- https://www.google.co.in/search?biw=1024&bih=667&q=ansys+software+free+download+for+windows+7+64+bit&sa=X&ved=0ahUKEwjm5o_MndHNAhUBsI8KHbRWDhUQ1QIIXCgB
- https://www.google.co.in/search?biw=1024&bih=667&q=ansys+software+free+download+for+windows+7+32+bit&sa=X&ved=0ahUKEwjm5o_MndHNAhUBsI8KHbRWDhUQ1QIIXSgC
- https://www.google.co.in/search?biw=1024&bih=667&q=ansys+software+tutorial&sa=X&ved=0ahUKEwjm5o_MndHNAhUBsI8KHbRWDhUQ1QIIXygE
- http://www.colorado.edu/MCEN/MCEN4173/Ansys_introduction.pdf
- http://www2.warwick.ac.uk/fac/sci/eng/study/pg/students/esrhaw/introduction_to_ansys.pdf
- http://www.mece.ualberta.ca/tutorials/ansys

SUGGESTED LIST OF STUDENT ACTIVITES

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur

1	Ask the students to take the simple problems in Strength of Materials, analyze the stresses by using software.
2	Ask the students to take the simple problems in Design of machine elements, analyze the stresses by using software.
3	At least take two simple mechanical components likes step turned shaft, measure the dimensions, Apply loads and analyze for stresses.
4	Study and understand the concept of theories of failure –Maximum shear stress theory, Maximum distortion energy theory (Von-Mises Theory of failure)
5	Identify the theory of failure for the brittle material and ductile materials

Course Delivery:

The course will be delivered through specific instructional strategies detailed as below

S.N.	Unit Name	Strategies
1	Introduction to Analysis software	Demonstration
2	Tutorial	Demonstration by any free software/ /Open source software
3	Problems for analysis.	Open source software

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
DIRECT ASSESSMENT	CIE (Continuous Internal Evaluation)	IA Tests	Students	Two Tests (Average of two tests to be computed)	10	Blue books	1,2,3
				Record Writing (Average marks of each exercise to be computed)	10	Record Book	1,2,3
				Activity	05	Report	1,2,3
				TOTAL	25		
	SEE (Semester End Examination)	End Exam		End of the course	50	Answer scripts at BTE	1,2,3
INDIRECT ASSESSMENT	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3, Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3 Effectiveness

						of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the performed activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

Serial no	Description		Marks	
1	**ANSYS** **Basic**	10		**20**
	Pre-processing	10		
2	**Solution, Post-processing**	10		**25**
3	**Result , Conclusion with analytical comparisons**	15		
4	**Viva**			**5**
		TOTAL		**50**

EQUIPMENT LIST: **Quantity: 01 Each**

Sr. No.	Resource with brief specification
1	Computer processor 500 GB HDD 1GB Graphics accelerator 2 GB RAM System-30 Nos 17" TEF Color Monitor Intel Core i3 /i5/i7
2	Color Desk Jet Printer-1 No
3	Operating system – Windows XP, Windows 7, Windows 8
3	Software ANSYS student Version (freely available)/Any open source software http://www.ansys.com/Products/Academic/ANSYS-Student

	Course Title: **PROJECT WORK (Mechanical Stream)**		
	Scheme (L:T:P) : **0:2:4**	Total Contact Hours: **78**	Course Code: 15ME66P
	Type of Course: **Practice**	Credit :**03**	Core/ Elective: **Practice**
CIE- 25 Marks			SEE- 50Marks

Prerequisites: Application learned concepts form the previous semester studied courses.

Course Objectives:

1. Learn the objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems/problems faced by industry/development of new facilities

2. Make the students come up with innovative/ new ideas in his area of interest.
3. Identify, analyze and develop opportunities as well as to solve broadly defined mechanical Engineering problems
4. Enhance students' appreciation of the values of social responsibility, legal and ethical principles, through the analysis and discussion of relevant articles and real time projects

Course outcome

On successful completion of the course, the students will be able to:

	Course Outcome	CL	Linked PO	Allotted hours
CO1	Get an idea and confidence in designing, analysing and executing the project.	Analysis/creation	1,2,3,4,8,9,10	
CO2	Apply the knowledge of latest trends in fabrication/ manufacturing and Relate their ideas while executing the project	Analysis/creation	1,2,3,4,8,9,10	
CO3	Have complete understanding of Executing the project	Analysis/creation	1,2,3,4,8,9,10	**6hrs/Week**
CO4	Prepare documents in team and enhance his written and oral communication presentations.	Analysis/creation	1,2,3,4,8,9,10	
CO5	Develop individual confidence to handle various engineering assignments and expose themselves to acquire life skills to meet societal challenges	Analysis/creation	1,2,3,4,5,8,9,10	
		TOTAL		**78 Hours**

MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

Course	Programme Outcome									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	Basic knowledge	Discipline knowledge	Experiments a practice	Engineering Tools	Engineer and society	Environment & Sustainability	Ethics	Individual and Team work	Communication	Life long learning
PROJECT WORK	1	3	3	2	1	0	0	3	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

1. PROJECT WORK: 78 HRS

A. INTRODUCTION

The objective of the project work is to enable the students in convenient groups of minimum of 5 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

B. ROAD MAP FOR THE PROJECT

1. Carry out a session or a seminar from the ISTE Student Chapter coordinator / Programme coordinator with the help of Innovation club / I I I cell for directing the students to identify project areas in the field of their interested including interdisciplinary areas.
2. Power point presentation in seminar should include detail description of project areas related to program, Project report formats, developing personnel writing skills.
3. The Students/Departments may at liberty to form the batch not less than 5 and maximum 8 and get registered with project coordinator/HOD at the end of V semester.
4. Students should take the approval from the Project committee/ Head of department for doing project.
5. After approval the batch of students will be published in department notice board along with guide in the end of 5th semester.
6. All students should finalize their Project immediately before commencement of SEE of 5th semester.
7. The types of project may include:
   - Industrial case study

- Preparation of a feasibility report
- Design and development of equipment.
- The overhauling of existing equipment
- Creation of New facilities

8. The project should be challenging but manageable within the resources and time available.
9. Students should undergo reviews for one times in^{5th} and one times in ^{6th} semester during the internal assessment. Time table for IA should include project review.The guide should monitor the progress of Project work periodically and it should be finally evaluated for 25 marks at the end of ^{5th} semester and for 25 marks at the end of ^{6th} semester.
10. The IA marks will be evaluated based on oral presentation and assessment by the internal guide by adopting Rubrics being developed by Project committee.
11. Real time problems, Industry related problems, should be chosen and it is a Responsibilities of the project committee / Programme coordinator/ Innovation club / I.I.T. cell to choose the appropriate project and to accept the Project Proposal
12. **Identification of Topic:** The selection of topic is of crucial importance. It should be field of interest. It is advisable to choose the project can be completed on time and within the budget and resources. The topic should be clear, directional, focussed and feasible.
13. An outline of project proposal submitted & synopsis from student will initiate a dialogue between Student and Project coordinator who will then help you to work on the chosen topic and report.

C. Industrial visit

Students are required to undergo an industrial visit for period of at least 3(Three) working days, in V semester only. After completion of their visit the reports should be prepared. Each Student should write the report independently in view of his own observation in industry. All days for the visit should be accounted for clearly giving attendance particulars. The concern accompanying staff is to check student presence and access progress periodically

D.Industrial report

Students are required to submit a comprehensive report on factory visit with details of the organization where the training was undergone. The comprehensive report should focus on study of plant/ product /process/ along with intensive in-depth study on anyone of the topics such as processes, methods, tooling, plant layout and equipment, highlighting aspects of quality, productivity of the system. Any data, drawings etc should be incorporated with the consent of the Organization. The comprehensive report should be submitted for the end exam for evaluation

E. Thrust areas identified for Project work

Each student may be assigned any one of the following types of project/thesis work:

According to the local needs, the following major projects are suggested:

1. Non-conventional energy

- Low Cost Solar Water Heating System for Domestic Purpose
- Fabrication of Solar cooker
- Study of Community Biogas Plant
- Fabricate a thermally efficient wood burning stove
- Solar lamps
- Solar powered refrigerator

2. Mechatronics/Material handling area

- Motorized object lifting jack
- Key controlled- fork lifter
- Object counting machine
- Stepper motor control with selected steps for conveyor belts
- Robotic arm with gripper
- Material handling device in X,Y,Z motion control
- Robotic crane
- Robotic trolley for material handling

3. Fluid power and control area

Pneumatic/Hydraulic jack
Pneumatic/hydraulic crane
Air compressed spray gun
Pneumatic transport system

4. Automobile related area

Regenerative braking system
Steering controlled headlight
Engine/motor vibration checker
Seat belt automatic locking system
Hydraulic braking
Electromagnetic shock absorber
Digital auto speed limiter

5. Motorized wheel chair
6. Design and Fabrication of various types of lab equipment's useful to polytechnic
7. Repair and overhauling of various machine tools and lab equipment's available at polytechnic
8. Critical Study of existing quality systems and inventory control at industry
9. Mechanical industry fabrication related projects
10. Automatic mopping machine to clean the floor area
11. Automatic milling machine with digital control
12. PCB fabrication
13. Any study project related to Mechanical and allied areas in industry
14. Any project related to industry based problems
15 .Any projects related to low cost automation

F. Course Assessment and Evaluation Scheme for Project work

	What			When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment met	CIE	IA	Students	At the end of 5 semester)	25	**1.** Project Synopsis. **2.** Plan & Schedule **3.** Industrial visit report	CO1, CO2, CO3,CO4,CO5
				At the end of 6 semester)	25	**1.** Project Report. **2.** Presentation hand outs	CO1, CO2, CO3,CO4,CO5
	SEE	End Exam		End of the course	50	CO1, CO2, CO3,CO4,CO5 Project report project model/Study report	
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	CO1Delivery of course
	End of Course Survey			End of the course		Questionnaires	CO1 to CO5 Effectiveness of Delivery of instructions & Assessment Methods

***CIE** – Continuous Internal Evaluation   ***SEE** – Semester End Examination

G. Project report

The Project Report should consist of following items.

1. Introduction
2. Review of Literature
3. Study Area
4. Methodology/Design/fabrication/Tests
5. Result and Discussion
6. Conclusion and scope for future study
7. References.

1. Project reports should be typed neatly in Times New Roman letters with font size 14 for titles and 12 for text on both sides of the paper with 1.5 line spacing on a A4 size paper (210 x 297 mm). The   margins should be: Left - 1.5",   Right - 1", Top and Bottom - 0.75".

2. The total number of reports (**Soft bound**) to be prepared are

- One copy to the department /library

- One copy to the concerned guide(s)
- One copy to the candidate.

3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

4. Every copy of the report must contain

➢ Inner title page (White)

➢ Outer title page with a plastic cover

➢ Candidate declaration and Certificate in the format enclosed both from the institution and the organization where the project is carried out.

➢ An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

5. The organization of the report should be as follows

1. Inner title page 2. Abstract or Synopsis 3. Acknowledgments 4. Table of Contents 5. List of table & figures (optional)	Usually numbered in roman

Chapters(to be numbered in Arabic) containing Introduction-, which usually specifies the scope of work and its importance and relation to previous workand the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.

The **chapter must be left or right justified** (**font size** 16). Followed by the **title of chapter centered** (**font size 18**), **section/subsection numbers along with their headings must be left justified** with **section number and its heading in font size** 16 and **subsection and its heading in font size** 14. The **body or the text** of the report should have font size 12.

The figures and tables must be numbered chapter wise

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

Reference or Bibliography: The references should be **numbered serially** in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.

1. For textbooks – Dr.Paramar S, Welding process and technology, Khanna publishers, New Delhi, 2 Edition, 2003.

2. For papers – Y.Javadi and I.sattari, Welding distortion in pipes, Journal of pressure vessels and piping, Vol 85, Aug 2008, pp 337-343

Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g.

- **V = IZ** .... **(3.2)**

All equation numbers should be right justified.

Separator sheets, used if any, between chapters, should be of thin paper

I.CIE ASSESSMENT FOR FINAL REVIEW(VI semester)	
1. Relevance of the subject in the present context	05 mark
2. Literature Review	05 mark
3. Plan and schedule of Fabrication of the model /Data collection/repair and Overhauling work /creation	10mark
4. Results & Discussion	05 mark
	25 Marks

J.SEE ASSESSMENT:	
1. Relevance of the subject in the present context	05 mark
2. Literature Review	05 mark
3. Fabrication of the model/Data collection/repair and Overhauling work/creation	25 mark
4. Results & Discussion	05 mark
5. Presentation	10 mark
TOTAL	**50 mark**

MODEL OF RUBRICS FOR ASSESSING REVIEWS OF PROJECT FOR CIE

Student name	Reg no	Dimension	Scale					Students Score				
			Unsatisfactory	Developing	satisfactory	Good	Exemplary	1	2	3	4	5
		Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic					
		Fulfil team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles					
		Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.					
		Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount					
							Grand Average/Total					

TITLE OF PROJECT REPORT

<Font Size 18><1.5 line spacing>

A PROJECT REPORT

<Font Size 14>

Submitted by

<Font Size 14><Italic>

NAME OF THE CANDIDATE(S)

<Font Size 16>

in partial fulfilment for the award of the diploma

of

<Font Size 14><1.5 line spacing><Italic>

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME

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IN

DEPARTMENT OF MECHANICAL ENGINEERING

<Font Size 14>

LOGO

NAME OF THE COLLEGE

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DEPARTMENT OF TECHNICAL EDUCATION

BENGALURU-560001

<Font Size 16><1.5 line spacing>

Year of submission: (MONTH & YEAR)

<Font Size 14>

(A typical Specimen of Title Page) <Font Style Times New Roman – Bold>

A Project Report
on

<TITLE OF THE PROJECT WORK>

Submitted for partial fulfilment of the requirements for the award of the
of

DIPLOMA IN CIVIL ENGINEERING

BY
BATCH
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>
<Mr. / Ms. Name of the Student (Roll No.)>

Under the guidance of

<Name of the Staff>
Lecturer
Department of ME
GPT, Place--------

Department of Mechanical Engineering
<<**NAME OF INSTITUTE**>>
<<**ADDRESS OF INSTITUTE**>>

(A typical specimen of Bonafide
Certificate)
<Font Style Times New Roman>

DEPARTMENT OF TECHNICAL EDUCATION
BENGALURU-560001
<Font Style Times New Roman – size -18>

BONAFIDE CERTIFICATE
<Font Style Times New Roman – size -16>

<Font Style Times New Roman – size -14>

Certified that this project report **"……….TITLE OF THE PROJECT…………….."**is the bonafide work of "**…………..NAME OF THE CANDIDATE(S)………….."**who carried out the project work under my supervision.

<<Signature of the Head of the Department>>   <<Signature of the Project coordinator>>

SIGNATURE   **SIGNATURE**

<<Name>>   <<Name>>

HEAD OF THE DEPARTMENT   **PROJECT CORDINATOR**

<<Academic Designation>>

<<Department>>   Department of Mechanical Engineering

<<Full address of the Dept & College >>   <<Full address of the Dept & College >>

Examiners 1......................<<Signature, Name, Designation& Address>>........

Examiners 2......................<<Signature, Name, Designation& Address>>........

11

CANDIDATE'S DECLARATION

I, --------------------------------------- a student of Diploma in ------------------------------ Department bearing Reg No--------------------------------------of --- hereby declare that I own full responsibility for the information, results and conclusions provided in this project work titled **"**---"submitted to **StateBoard of Technical Examinations, Government of Karnataka** for the award of Diploma in ---------------------------------.

To the best of my knowledge, this project work has not been submitted in part or full elsewhere in any other institution/organization for the award of any certificate/diploma/degree. I have completely taken care in acknowledging the contribution of others in this academic work. I further declare that in case of any violation of intellectual property rights and particulars declared, found at any stage, I, as the candidate will be solely responsible for the same.

Date:

Place: **Signature of candidate**

                                                                                              Name: -----------------

---

                                                                                              Reg No-----------------

--

DEPARTMENT OF TECHNICAL EDUCATION

NAME OF THE INSTITUTION

Address with pin code

Department of ……………………………………………….

CERTIFICATE

Certified that this project report entitled --- ---- -------------------—--**"**which is being submitted by Mr./Ms. ………………………….………………….., Reg. No…..……………, a bonafide student of ………………………………….in partial fulfilment for the award of **Diploma in -----------------Engineering** during the year ……………………... is record of students own work carried out under my/our guidance.It is certified that all corrections/suggestions indicated for internal Assessment have been incorporated in the Report and one copy of it being deposited in the polytechnic library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said diploma.

It is further understood that by this certificate the undersigned do not endorse or approve any statement made, opinion expressed or conclusion drawn there in but approve the project only for the purpose for which it is submitted.

Guide(s)

Name and signature

Examiner   1

　　　　　　2　　　　　　　　　　　　　　　　　　　　　**Head of Department**

Dept. of --------------------

Directorate Of Technical Education　　　　　**Karnataka StateMECH**

Format of Synopsis

1. Title of the Project

2. Objectives of the study

3. Rationale for the study

4. Statement of the Problem

5. Detailed Methodology to be used for carrying out the study

6. The expected contribution from the study (to perform any laboratory experiments)

7. List of activities to be carried out to complete the project (with the help of a bar chart showing the time schedule)

8. Places/labs/equipment and tools required and planning of arrangements

9. Problems envisaged in carrying out the project, if any.

10. Brief description of project in 100 words

APPENDIX-7 (PROJECT-TIME LINE)

SL.No	TASK	Responsibility	END OF V SEMESTER					VI SEMESTER												
	WEAKS		11	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Industrial visit	Students/Faculty	■																			
1	Seminar regarding Project work	Project Com/HOD		■																		
2	Batch formation &Guide allocation	HOD			■																	
3	Identification of project	Students/Guide				■																
4	Project synopsis Submission	Students					■															
5	Finalisation of Project	Students/Guide					■															
6	Literature survey	Students/Guide						■														
7	Identification of facility to do PW	Guide							■	■												
8	Study/Fabrication/design of model	Students/Guide									■	■	■	■	■	■	■				
9	Results discussion/performance testing	Students																	■			

1

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10	Review of Project work by guide	Students																			▨	
11	Project report submission	Students/Guide																				▨

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	Course Title: **INPLANT TRAINING (Mechanical Stream)**		
	Scheme: **4hrs/week**	Total Contact Hours: **52**	Course Code:15ME67P
	Type of Course: **Periodical Exposure and working in industrial environment**	Credit :**02**	Core/ Elective: **Core(practice)**
CEE:25 Marks			

Prerequisites: Enthusiasm to Explore New things by participating in individual tasks available in outside industrial learning environment and acquires skills from participating in such activities.

Course Objectives:

An In plant training is a learning opportunity for students. Students should therefore receive feedback on their performance so that they can grow professionally. Overall professional development of diploma mechanical engineers is the need of the day for enabling them to sustain in competitive global environment..

COURSE OUTCOME

On successful completion of the course, the students will be able to:

	Course Outcome	CL	Linked PO	Allotted hours
CO1	Exposure to the industrial environment and Recognize the requirement of the industry and cope up with the industrial scenario	Application/Analysis/Innovative	2,3,4,10	
CO2	Identify career paths taking into account their individual strengths and aptitude and Prepare a report about the work experience in industry	Application/Analysis/Innovative	2,8,9,10	
CO3	Communicate effectively through technical presentation.	Application/Analysis/Innovative	2,9	**4 hrs/weak**
CO4	Enhancing the employability skills and start-up skills to increase his ability to engage in, life-long learning,	Application/Analysis/Innovative	2,3,4,10	
CO5	Develop individual confidence to handle various engineering assignments and expose themselves to acquire life skills to meet societal challenges	Application/Analysis/Innovative	2,3,5,8,10	
		TOTAL		**52 Hours**

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COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
INPLANT TRAINING	0	3	2	2	1	0	0	2	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

1. In plant training: 52 HRS

A. Introduction

1. In-plant training means a course of training in any industry or establishment undergone by the student of final year diploma in Mechanical engineering in pursuance of memorandum of understanding between industry and department of the concerned institute or department can make necessary arrangements in the local vicinity industries to expose their students for industry learning environment.

2. Industry means any industry or business in which any trade, occupation or subject field in engineering or technology may be specified as a designated trade. Establishment includes any place where any industry is carried on.

3. The period of in-plant training will be the period of one semester term for the subject. The student can sent to the industry for one day in a weak or for fixed term as the case may be .The period of training and other modalities will be decided by the respective department head in consultation with local industry authorities.

B. The Industries where in plant training can undergone

1. The Guide allotted by the department head have liberty to select nearby organization/industry of local vicinity with prior approval of principal of the institute. Structured training to be arranged by guide and report of the same shall be submitted by the individual student, to full fill their term work.

2. The mechanical engineering diploma students can take in plant training in any one of the following industries.
   a. Public sector enterprises
   b. State government undertaking
   c. Public limited companies
   d. Private limited companies
   e. Individual ownership organisations
   f. Karnataka State Road Transport depot work shops
   g. Karnataka State Road Transport Regional body building work shops
   h. Karnataka Milk Federations Milk Processing and chilling units
   i. Agro based food processing units
   j. Agro based industries
   k. Farm machinery equipments manufacturing units

l. Local leading automobile dealer workshops
m. Stone crushers / Cement mix plant/ service stations of JCBs and other earthmoving equipment
n. Local heavy fabrication units
o. Power looms
p. Local Garment industries
q. Local cement industries
r. Paper mills
s. Sugar factories
t. Textile industry / Textile machinery manufacturing / garment manufacturing /embroidery / textile printing and dying units.
u. Any ancillary units
v. All MSMEs, recognised by state government
w. Karnataka power transmission master unit sub stations
x. The power generation units
y. Local diesel power plants
z. Automobile manufacturing / press component / auto component manufacturing units in local polytechnic vicinity

C. Obligation on students

1. To learn his/her subject field in Engineering or Technology conscientiously and diligently at his place of training.

2. To carry out all orders of his Employer and the Superior in the establishment.

3. To abide by the Rules and Regulations of the Industry/Establishment in all matters of conduct and discipline.
4. The student shall maintain a report of his work during the period of his in-plant training in a proforma Annexure-1
5. They are required to complete their in-plant training in a given period.
6. During this period, they shall be familiar with the understanding of the shop process and activities.
7. The students can be asked to solve the mini-shop problem, which will make them think and try out short experiments as an improvement in the process, tools and equipment.

D. Monitoring of In-Plant Training

1. The department ,Head will make the batches in group of students, The faculty will made in charge of supervising and monitoring the activity of the group
2. The faculty and Industry supervisor will work out a suitable arrangement to review the progress of the work from time to time. The department Head should monitor the progress of in-plant training in association with industry authority.
3. Every student undergoing in-plant training in the respective branch of Engineering in any Establishment shall be treated as a trainee. The provision of any law with respect to labour will not apply to such a trainee
4. It shall not be obligatory on the part of the Employer / Industry to offer any stipend and other welfare amenities available, if any, to the students undergoing in-plant training. However, if the industry desirous to do so, at will be a privilege for the students

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E.CIE - Scheme of Evaluation

1. CIE

SL No	Particulars	Marks
1	Involvement in implant training	05
2	Assessment of the term work	10
3	Seminar performance	05
4	Viva	05
	TOTAL	**25**

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assess	CIE	IA	Students	CIE	25	Report (Annexure1)	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3, Effectiveness of Delivery of instructions & Assessment Methods

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Student activities report for25 marks
2. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

Directorate Of Technical Education   Karnataka StateMECH

INPLANT TRAINING EVALUATION FORM
FOR THE STUDENTS OF FINAL YEAR DIPLOMA IN _____

Date:

1. Name of the Student and Reg. No.---
2. Father's Name   : .--
3. Branch   . ---
4. In plant training Offered   :   From----------- To---------------------

A**. Evaluation of the Student may be done with the following letter grades. The grade point for the letter grades is given below.**

Grades	A	B	C	D	E (low)
Points	5	4	3	2	1

B. **Assessment parameters**

Sl NO	Parameters	Grades awarded
1	Knowledge Acquired During Internship	
2	Ability to use Techniques and Methods Appropriate for Assignments	
3	Ability to Display the Technical Skills required	
4	Ability to Organize, Classify and Deliver the job	
5	Perseverance to Complete the job	
6	Takes Initiative and Works with Minimal Supervision	
7	Attendance and Punctuality	
8	Ability to Establish Positive Relationships with the Managers and Peers	
9	Personal Conduct and Behaviour	
10	Ability to Cope Up with the Stressful Situations	

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SL NO	Department (s)/Section(S)	Type of Work	Period	
			From	To

5. Areas where student excels:

6. Areas where student needs to improve:

7. Areas where student gained new skills, insights, values, confidence, etc.:

8. Did student demonstrate continued progress throughout the internship term?:

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9. Was student's academic preparation sufficient for this internship?

10. Additional comments or suggestions for the student?

11	Overall Evaluation of the in plant trainee Performance	Grade Awarded

Name / Signature of Officer In-charge (Training) :

Authorized Signatory   :

REPORT ON INPLANT TRAINING

FORMAT FOR PREPARATION OF TRAINING REPORT

(Four Weeks/Six Weeks/ Six Months)

ARRANGEMENT OF CONTENTS:

The sequence in which the training report material should be arranged and bound as follows:

1. Cover Page
2. Inner Title Page (Same as cover page)
3. Certificate by Company/Industry/Institute
4. Acknowledgement
5. About Company/industry/institute
6. Table of Contents
7. List of Tables
8. List of Figures
9. Abbreviations and Nomenclature(If any)
10. Chapters
11. References
12. Data Sheet(If any)
13. Appendices (If any)

The tables and figures shall be introduced in the appropriate places.

TYPING INSTRUCTIONS:

1. The In plant training report must be submitted in Two Copies (one for department and 2nd for library) duly signed by the HOD. Students should also submit the soft copy on CD in pdf format in the library.
2. The length of the   training report may be about 40 to 50 page.
3. The training report shall be computer typed (English- British, Font -Times Roman, Size-12 point) and printed on A4 size paper.
4. The training report shall be hard bound with cover page in Maroon color. The name of the students, degree, duration of training period, institute name shall be printed in **Bold Black** letters on the cover page

5. The training report shall be typed with 1.5 line spacing with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom. Every page in the report must be numbered. The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv...... The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5... All printed page numbers should be located at the bottom centre of the page.

6. In the training report, the title page [Refer sample sheet (inner title pager)] should be given first and printed in black letters.

7. **The table of contents** should list all headings and sub-headings. The title page and certificates will not find a place among the items listed in the Table of Contents. One and a half line spacing should be adopted for typing the matter under this head.

8. **The list of tables** should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

9. **The list of figures** should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

10. The list of symbols, abbreviation & nomenclature should be typed with one and a half line spacing. Standard symbols, abbreviation etc should be used.

11. Training report should consist of following chapters.

    a. Chapter 1-   Introduction

    b. Chapter 2-   Details of department/Areas where the student undergone training

        (It will be divided into several chapters and each chapter should be numbered separately. A chapter may be further divided into several divisions and sub-divisions depending on the content

    c. Chapter 3-   PO/Skills attained by training.

    d. Chapter 4-   Conclusion by the student

APPENDIX-3 (INPLANT-TRAINING-TIME LINE)

SL.No	TASK	Responsibility	END OF V SEMESTER				Vacation in between V SEM-VI SEM /During the term VI SEMESTER (Not less than 2 weeks continuously)/ During-VI SEMESTER (Every Saturday in a week)														
	WEAKS /DAYS	HOD	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Seminar regarding In plant training	HOD	■																		
2	Batch formation &Guide allocation	HOD		■																	
3	Identification of Factory	Guide			■																
4	Permission form Factory authorities	Students				■															
5	Schedules of In plant training	Students/Guide				■															
6	INPLANT TRAINING	Students/Guide					■	■	■	■	■	■	■	■	■	■	■	■	■	■	
7	Review of Training by guide	Students											■							■	
8	Report submission	Students/Guide																			■

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MODEL LABORATORY MANUAL

COMPUTER AIDED ANALYSIS AND SIMULATION LABORATORY

## ACADEMIC YEAR 2017-18

Introduction to ANSYS

❖ ANSYS is a complete FEA software package used by engineers worldwide in virtually all fields of engineering:

- o Structural

- o Thermal

- o Fluid, including CFD (Computational Fluid Dynamics)

- o Electrical / Electrostatics

- o Electromagnetics

❖ A partial list of industries in which ANSYS is used:

- o Aerospace

- o Automotive

- o Bio-medical

- o Bridges & Buildings

❖ ANSYS/Multiphysics is the flagship ANSYS product which includes all capabilities in all engineering disciplines.
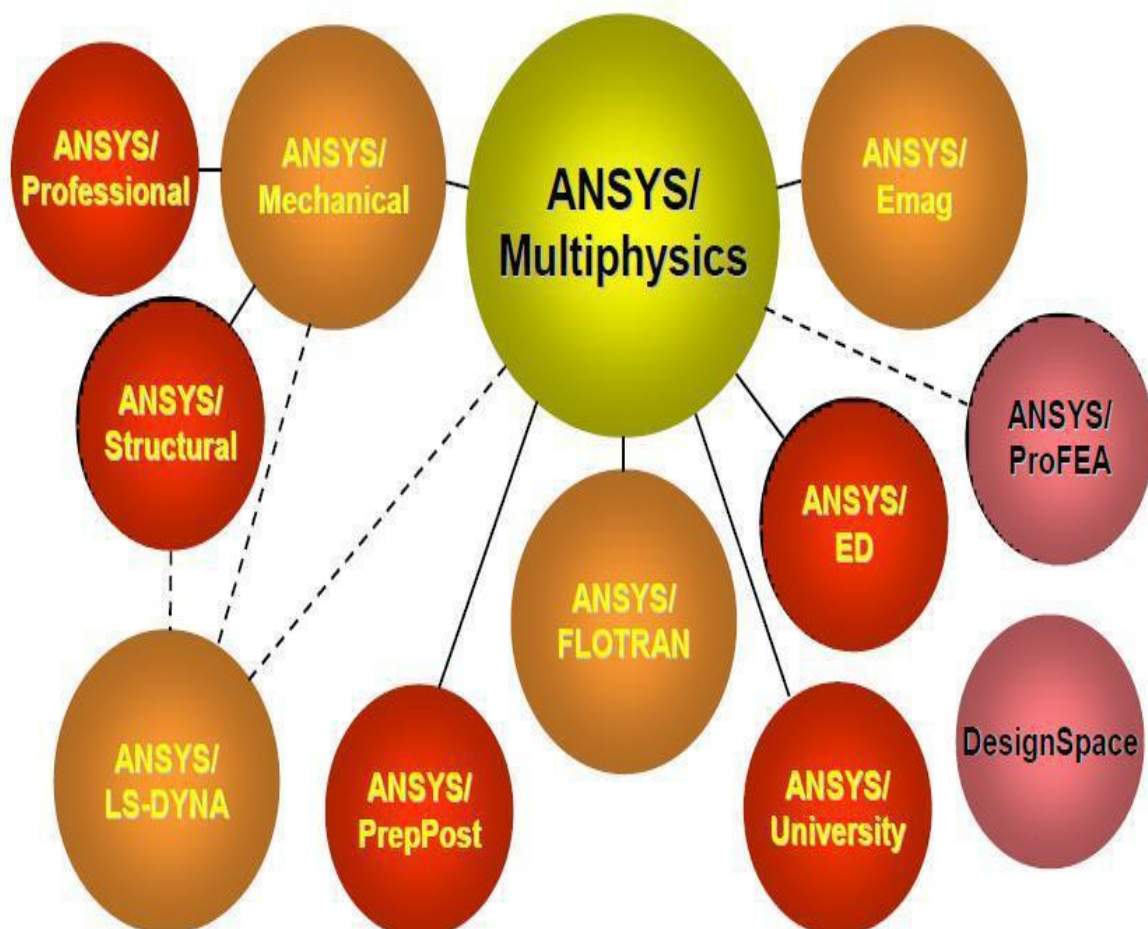
❖ There are three main component products derived from ANSYS/Multiphysics:
  ○ ANSYS/Mechanical - structural & thermal capabilities

  ○ ANSYS/Emag - electromagnetics

  ○ ANSYS/FLOTRAN - CFD capabilities

❖ Other product lines:
  ○ ANSYS/LS-DYNA - for highly nonlinear structural problems

  ○ Design Space - an easy-to-use design and analysis tool meant for quick analysis within the CAD environment

  ○ ANSYS/ProFEA - for ANSYS analysis & design optimization within Pro/ENGINEER

❖ **Structural analysis:** is used to determine deformations, strains, stresses, and reaction forces.
  ○ Static analysis
    ▪ Used for static loading conditions.
    ▪ Nonlinear behavior such as large deflections, large strain, contact, plasticity, hyper elasticity, and creep can be simulated
  ○ Dynamic analysis
    ▪ Includes mass and damping effects.
    ▪ Modal analysis calculates natural frequencies and mode shapes.
    ▪ Harmonic analysis determines a structure's response to sinusoidal loads of known amplitude and frequency.

    ▪ Transient Dynamic analysis determines a structure's response to time-varying loadsand can include nonlinear behavior.

  ○ Other structural capabilities
    ▪ Spectrum analysis
    ▪ Random vibrations
    ▪ Eigen value buckling
    ▪ Substructuring, submodeling
  ○ Explicit Dynamics with ANSYS/LS-DYNA
    ▪ Intended for very large deformation simulations where inertia forces are dominant.
    ▪ Used to simulate impact, crushing, rapid forming, etc.

❖ **Thermal analysis**: is used to determine the temperature distribution in an object. Other quantities of interest include amount of heat lost or gained, thermal gradients, and thermal flux. All three primary heat transfer modes can be simulated: conduction, convection, radiation.

  ○ Steady-State
    ▪ Time-dependent effects are ignored.
  ○ Transient
    ▪ To determine temperatures, etc. as a function of time.
    ▪ Allows phase change (melting or freezing) to be simulated.

O Electromagnetic analysis is used to calculate magnetic fields in electromagnetic devices.

O Static and low-frequency electro magnetic

▪ To simulate devices operating with DC power sources, low-frequency AC, or low- frequency transient signals.

❖ **Computational Fluid Dynamics (CFD)**

oTo determine the flow distributions and temperatures in a fluid.

oANSYS/FLOTRAN can simulate laminar and turbulent flow, compressible andincompressible flow, and multiple species.

o Applications: aerospace, electronic packaging, automotive design

o Typical quantities of interest are velocities, pressures, temperatures, and film coefficients.

The GUI Layout
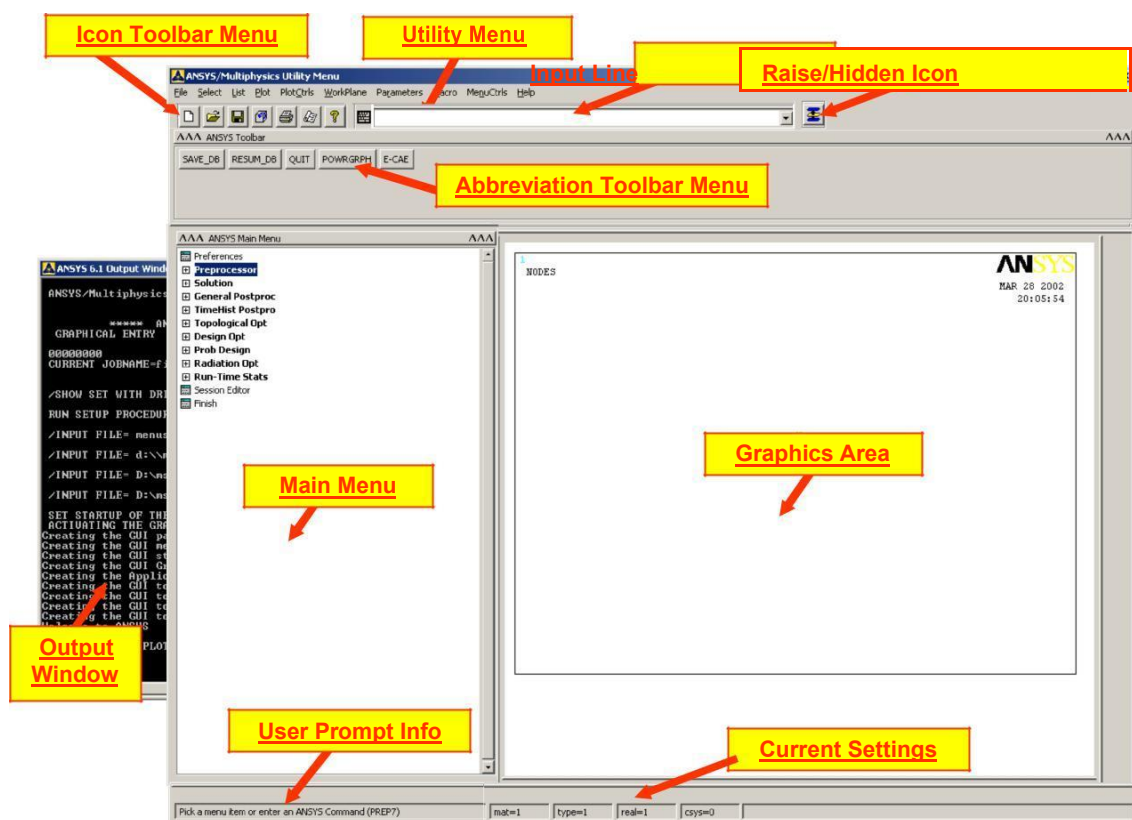
Utility Menu

Contains functions which are available throughout the ANSYS session, such as file controls, selecting, graphics controls, parameters, and exiting.

Toolbar Menu

Contains push buttons for executing commonly used ANSYS commands and functions. Customized buttons can be created.

Graphics Area

Displays graphics created in ANSYS or imported into ANSYS.

Input Line Displays program prompt messages and a text field for typing commands. All previously typed commands appear for easy reference and access.

Main Menu

Contains the primary ANSYS functions, organized by processors (preprocessor, solution, general postprocessor, etc.)

Output

Displays text output from the program. It is usually positioned behind the other windows and can be raised to the front when necessary.

Resume:

This is opening a previously saved database. It is important to know that if you simply resume a database, it doesn't change the job name. For example: You start ANSYS with a job name of —file‖. Then you resume my model.db, do some work, then save. That save is done to file.db! Avoid this issue by always resuming using the icon on the toolbar. If you open mymodel.db using this method, it resumes the model and automatically changes the job name to my model.

Plotting:

Contrary to the name, this has nothing to do with sending an image to a plotter or printer. Plotting in ANSYS refers to drawing something in the graphics window. Generally you plot one type of entity (lines, elements, etc.) to the screen at a time. If you want to plot more than one kind of entity use, —Plot → Multiplot‖, which by default will plot everything in your model at once.

Plot Controls:

This refers to how you want your —plot‖ to look on the screen (shaded, wire frame, entity numbers on or off, etc). Other plot control functions include sending an image to a graphics file or printer.

Creating Geometry:

Geometry in ANSYS is created from

—Main Menu → Preprocessor → Modeling → Create‖ and has the following terminology,

KEYPOINTS: These are points, locations in 3D space.

LINES: This includes straight lines, curves, circles, spline curves, etc. Lines are typically defined using existing key points.

AREAS: This is a surface. When you create an area, it's associated lines and key points are automatically created to border it.

VOLUMES: This is a solid. When you create a volume, it's associated areas, lines and key points are automatically created.

SOLID MODEL: In most packages this would refer to the volumes only, but in ANSYS this refers to your geometry. Any geometry. A line is considered a —solid model‖.

You can't delete a child entity without deleting its parent, in other words you can't delete a line if it's part of an area, can't delete a key point if it's the end point of a line, etc.

Boolean Operations:

Top Down style modeling can be a very convenient way to work. Instead of first creating key points, then lines from those key points, then areas from the lines and so on (bottom up modeling), start with volumes of basic shapes and use Boolean operations to add them, subtract them, divide them etc. Even if you are creating a shell model, for example a box, you could create the box as a volume (a single command) and then delete the volume keeping the existing areas, lines and key points.

These kinds of operations are found under —Main Menu → Preprocessor → Modeling → Operate → Booleans‖ with some common ones being:

Add: Take two entities that overlap (or are at least touching) and make them one.

Subtract: Subtract one entity from another. To make a hole in a plate, create the plate (area of volume) then create a circular area or cylinder and subtract it from the plate.

Glue: Take two entities that are touching and make them contiguous or congruent so that when meshed they will share common nodes. For example, using default mesh parameters,
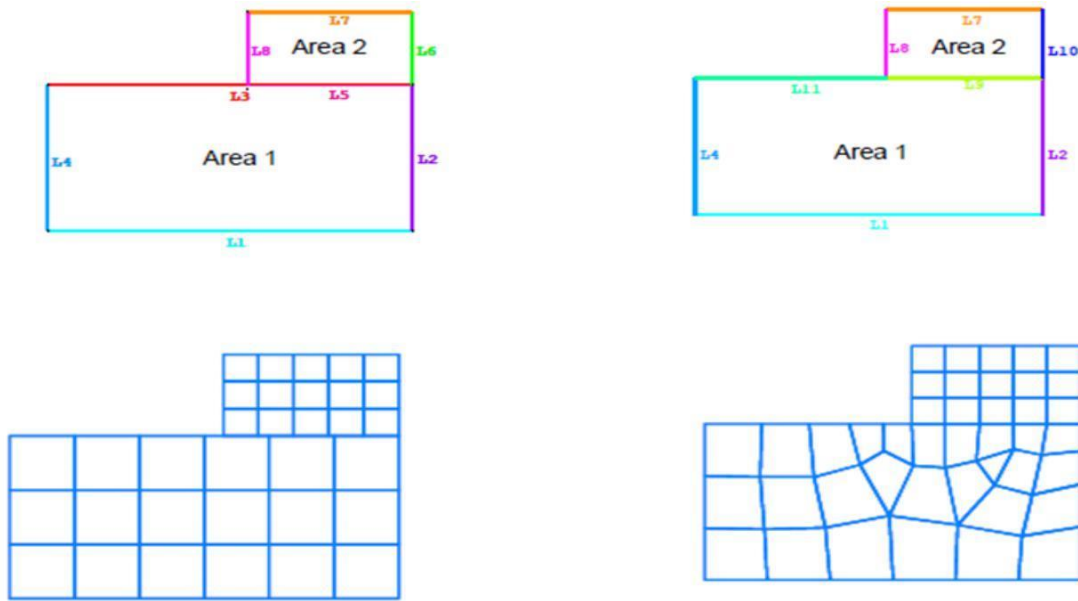
Meshing without gluing areas.   Meshing after gluing areas.

Note: In case of Meshing after gluing areas. The coincident nodes on the common line between the two areas will be automatically merged. You don't have to manually equivalence them like in some other codes.

The Working Plane:

All geometry is created with respect to the working plane, which by default is aligned with the global Cartesian coordinate system. The ―Working Plane‖ is actually the XY plane of the working coordinate system. The working coordinate system ID is coordinate system 4 in ANSYS. Global Cartesian is ID 0, Global Cylindrical is ID 1, and Global Spherical is ID 2.

Working Plane Hints:

Turn on the working plane so you can see it with, ―Utility Menu → Work Plane → Display Working Plane‖.

Change the way the working plane looks or adjust the snap settings under ―Utility Menu → Work Plane → WP Settings…‖.

Move the working plane around using ―Utility Menu → Work Plane → Offset WP to…‖.

Align the working plane with various parts of the model using ―Utility Menu → Work Plane → Align WP with…‖.

If you select more than one node or keypoint to offset the working plane to, it will go to the average location of the selected entities. VERY handy!

Use the working plane to slice and dice your model. For example to cut an area in pieces use ―Main Menu → Modeling → Operate → Booleans → Divide → Area by WrkPlane‖. Do this for lines and volumes as well.
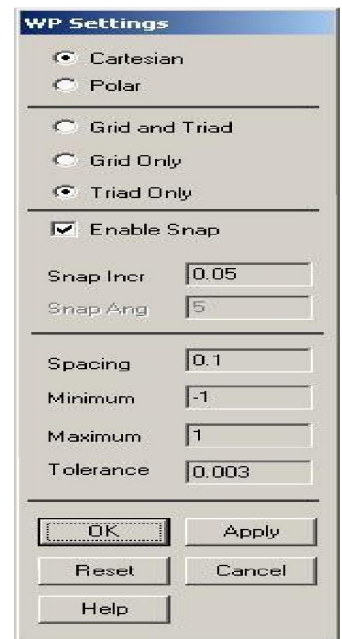
Select Logic:

Selecting is an important and fundamental concept in ANSYS. Selected entities are your active entities. All operations (including Solving) are performed on the selected set. In many operations you select items ―on the fly‖; ANSYS prompts for what volumes to mesh for example, you pick them with the mouse, and ANSYS does the meshing.

However there are many times when you need to select things in more sophisticated ways. Also, in an ANSYS input file or batch file you can't select things with the mouse!

Examples where this would be useful:

• You have many different areas at Z = 0 you want to constrain. You could select them all one by one when applying the constraint, or select ―By Location‖ beforehand, then say ―Pick All‖ in the picking dialog.

• You have a structure with many fastener holes that you want to constrain. Again, you could select them all one by one when applying the constraint, or select lines ―By Length/Radius‖, type in the radius of the holes to select all of them in one shot, then ―Pick All‖ in the picking dialog when applying the constraint.

After working with the selected set,

―Utility Menu → Select → Everything‖ to make the whole model active again.
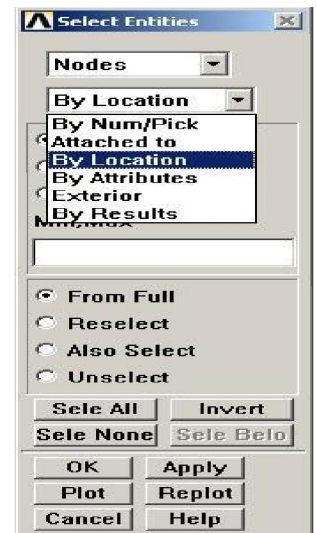
Select Entities Dialog Box Terminology:

From Full: Select from the entire set of entities in the model.

Reselect: Select a subset from the currently selected entities.

Also Select: Select in addition to (from the whole model) the set you have currently selected.

Unselect: Remove items from the selection set.

Select All: This is not the same as ―Utility Menu → Select → Everything‖. This selects all of whatever entity you have specified at the top of the dialog.

**Invert:** Reverses the selected and unselected entities (just the entities specified at the top of the dialog).

OK: This does the select operation (or brings up a picker dialog so that you can pick with the mouse) and then dismisses the dialog.

Apply: This does the operation but keeps the dialog box. Typically use this so the dialog stays active.

Replot: Replots whatever is active in the graphics window.

Plot: Plots only the entity specified at the top of the dialog.

### Organizing Your Model Using Components:
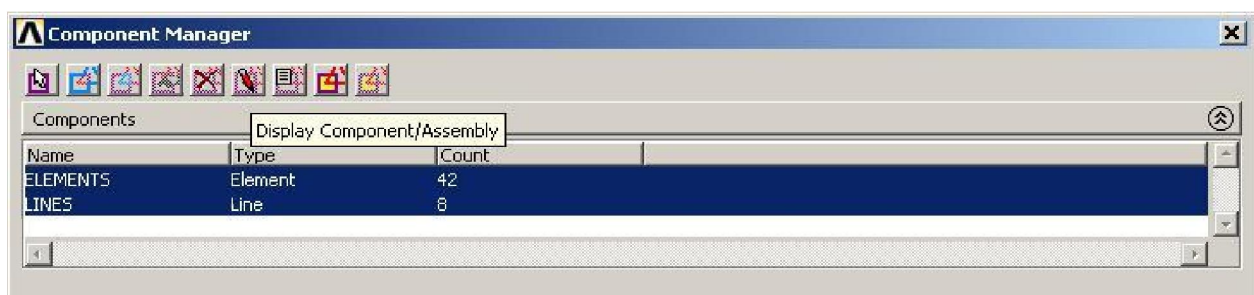
If you select a group of entities and think that you might want to use that selection set again, create a component out of it. Components are groups of entities but hold only one kind of entity at a time. Components can themselves be grouped into Assemblies, so this is how you group different types of entities together. Use ―Utility Menu → Select → Comp/Assembly → Create

Component…‖ to create a component. The new Component Manager in Release 8.0 makes it very easy to manage and manipulate groups and select/plot what you want to see to the screen. This is found under ―Utility Menu → Select → Component Manager‖

Creating a Material:

Create the material properties for your model in ―Main Menu → Preprocessor → Material Props → Material Models‖. This gives you this dialog box where all materials can be created,
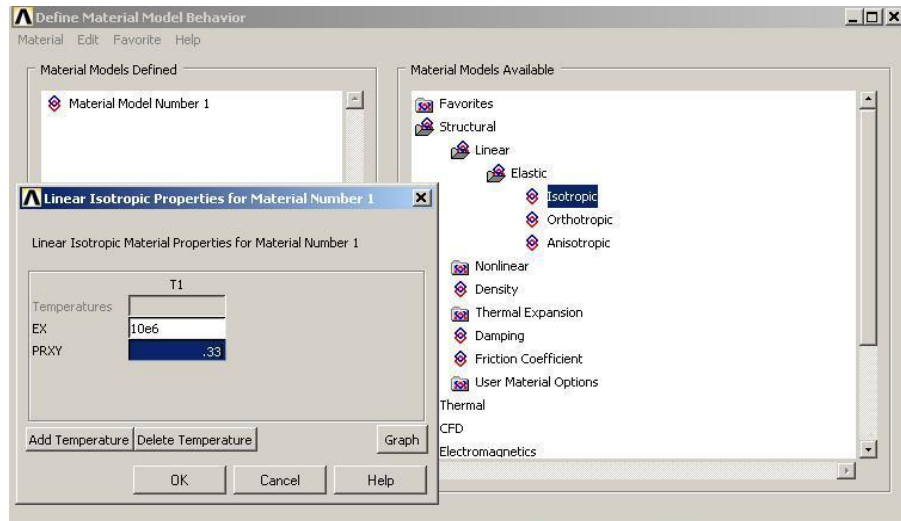
Double click on items in the right hand pane of this window to get to the type of material model you want to create. All properties can be temperature dependant. Click OK to create the material and it will appear in the left hand pane. Create as many different materials as you need for your analysis.

Selecting an Element Type:

ANSYS has a large library of element types. Why so many? Elements are organized into groups of similar characteristics. These group names make up the first part of the element name (BEAM, SOLID, SHELL, etc). The second part of the element name is a number that is more or less (but not exactly) chronological. As elements have been created over the past 30 years the element numbers have simply been incremented. The earliest and simplest elements have the lowest numbers (LINK1, BEAM3, etc), the more recently developed ones have higher numbers. The ―18x‖ series of elements (SHELL181, SOLID187, etc) are the newest and most modern in the ANSYS element library.

Tell ANSYS what elements you are going to use in your model using ―Main Menu → Element Type → Add/Edit/Delete‖
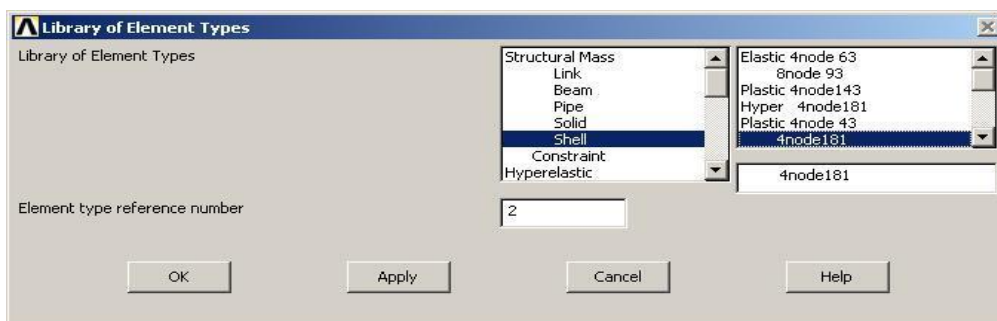
Later, when meshing or creating elements manually you will need to tell ANSYS what type of elements you want to create.

Creating Properties A solid element (brick or tet) knows its thickness, length, volume, etc by virtue of its geometry, since it is defined in 3D space. Shell, beam and link (truss) elements do not know this information since they are a geometric idealization or engineering abstraction. Properties in ANSYS are called Real Constants. Define real constants using ―Main Menu → Real Constants → Add/Edit/Delete‖.
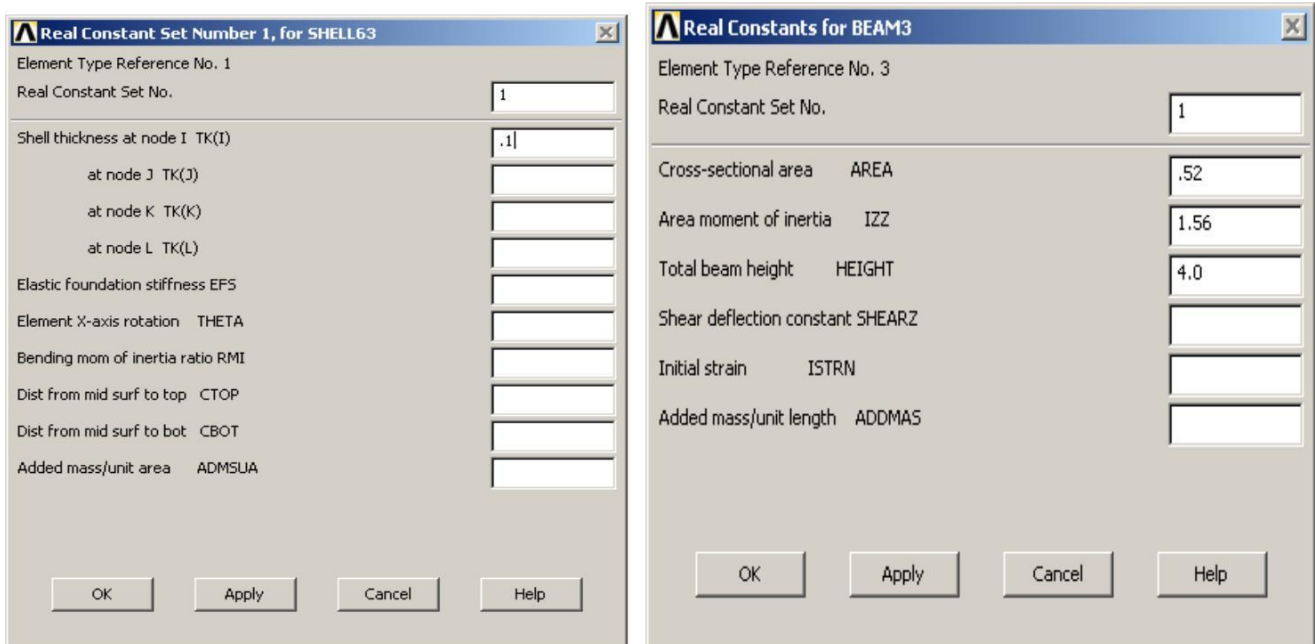
Creating the Finite Elements Model - Meshing:

 If you are just starting out in FEA, it is important to realize that your geometry (called the solid model in ANSYS) is not your finite element model. In the finite element method we take an arbitrarily complex domain, impossible to describe fully with a classical equation, and break it down into small pieces that we can describe with an equation. These small pieces are called finite elements. We essentially sum up the response of all these little pieces into the response of our entire structure The solver works with the elements. The geometry we create is simply a vehicle used to tell ANSYS where we want our nodes and elements to go. While you can create nodes and elements one by one in a manual fashion (called direct generation in ANSYS) most people mesh geometry because it is much another very good reason we mesh geometry is that we assign materials and properties to that geometry.

Then any element created on or in that geometric entity gets those attributes. If we don't like the mesh we can clear it and re-mesh, without having to re-assign the attributes.

Steps for Creating the Finite Elements:

- Assign Attributes to Geometry (materials, real constants, etc).
- Specify Mesh Controls on the Geometry (element sizes you wa
- Mesh.

Most of the meshing operations can be done within the MeshTool, so that will be examined in some detail now. Start it from ―Main Menu → Preprocessor → Meshing → MeshTool‖.

Smart Size is used to automatically pick the element edge length depending on the sizes of features in the geometry. It makes a finer mesh around smaller Features in order to capture them adequately.

For example in the mesh below no sizes were specified at all except a Smart Size level of 4.

A mapped mesh generates a very regular grid of elements. This can only be used on rectangular shaped areas or volumes. A free mesh will mesh any entity regardless of shape.
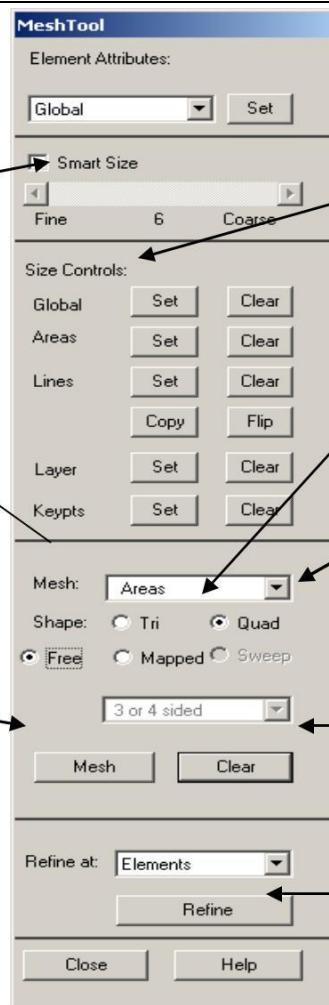
If you want to set a specific element edge length on an entity or tell ANSYS to put some specific number of elements along a line for example, use this.

Pick what you want to mesh.

Shape of the element you want to create. For Volumes you would have the choice of Hex or Tet. You can create beam elements by meshing lines.

Brings up a picker dialog. Pick the entities to be meshed (or *Pick All* if you have made some selection using select logic), press OK, and ANSYS generates the nodes and elements on/in that geometry.

Brings up a picker dialog. You pick the entities to be cleared, press OK, and ANSYS removes the nodes and elements from that geometry.

Refine the mesh (make more nodes and elements locally) at a specific location (elements, nodes, kepoints, lines,etc.).

Applying Loads and Boundary Conditions:

Loads and boundary condition can be applied in both the Preprocessor

(―Main Menu → Preprocessor → Loads → Define Loads → Apply‖), and the Solution processor

(―Main Menu → Solution → Define Loads → Apply‖).

    1. Select the kind of constraint you want to apply.

    2. Select the geometric entity where you want it applied.

    3. Enter the value and direction for it.

There is no ―modify‖ command for loads and B.C.'s. If you make a mistake simply apply it again with a new value (the old one will be replaced if it's on the same entity), or delete it and reapply it.

Loads: Forces, pressures, moments, heat flows, heat fluxes, etc.

Constraints: Fixities, enforced displacements, symmetry and anti-symmetry conditions, temperatures, convections, etc.

Although you can apply loads and boundary conditions to nodes or elements, it's generally better to apply all B.C.'s to your geometry. When the solve command is issued, they will be automatically transferred to the underlying nodes and elements. If B.C.'s are put on the geometry, you can re-mesh that geometry without having to reapply them

Solving:

Solution is the term given to the actual simultaneous equation solving of the mathematical model. The details of how this is done internally is beyond the scope of this guideline but is addressed in a separate ―ANSYS Tips‖ white paper. For the moment, it is sufficient to say that the basic equation of the finite element method that we are solving is, $[K]\{u\}=\{F\}$

   where $[K]$ is the assembled stiffness matrix of the

   structure, $\{u\}$ is the vector of displacements at each

   node, and $\{F\}$ is the applied load vector.

This is analogous to a simple spring and is the essence of small deflection theory.

To submit your model to ANSYS for solving, go to **"Main Menu → Solution → Solve → Current LS". LS** stands for load step. A load step is a loading ―condition‖.

This is a single set of defined loads and boundary conditions (And their associated solution results. More on this in the next section). Within an interactive session the first solve you do is load step 1, the next solution is load step 2, etc.

If you leave the solution processor after solving to do post-processing for example, the load step counter gets set back to one. You can also define and solve multiple load steps all at once.

There are several solvers in ANSYS that differ in the way that the system of equations is solved for the unknown displacements. The two main solvers are the sparse solver and the PCG solver.

If the choice of solvers is left to ―program chosen‖ then generally ANSYS will use the sparse solver. The PCG (preconditioned conjugate gradient) solver works well for models using all solid elements. From a practical perspective one thing to consider is that the sparse solver doesn't require a lot of RAM but swaps out to the disk a lot. Disk I/O is very slow. If you have a solid model and lots of RAM the PCG solver could be significantly faster since the solution runs mostly in core memory

Postprocessing:

The General Postprocessor is used to look at the results over the whole model at one point in time. This is the final objective of everything we have discussed so far; finding the stresses, deflections, temperature distributions, pressures, etc. These results can then be compared to some criteria to make an objective evaluation of the performance of your design.

The solution results will be stored in the results file as result ―sets‖. For a linear static analysis like we are talking about, the correlation between Load Step numbers and Results Set numbers will be one to one as shown below. Only one set of results can be stored in the database at a time, so when you want to look at a particular set, you have to read it in from the results file. Reading it in clears the previous results set from active memory.

To read in a results set from the results file (not needed if you have run only a single load step) use ―Main Menu → General Postprocessor → Read Results → First Set, or By Pick‖. Most results are displayed as a contour plot as shown below. To generate a plot of stresses use ―Main Menu → General Postproc → Plot Results → Contour Plot → Nodal Solution‖, then pick the stresses you want to see
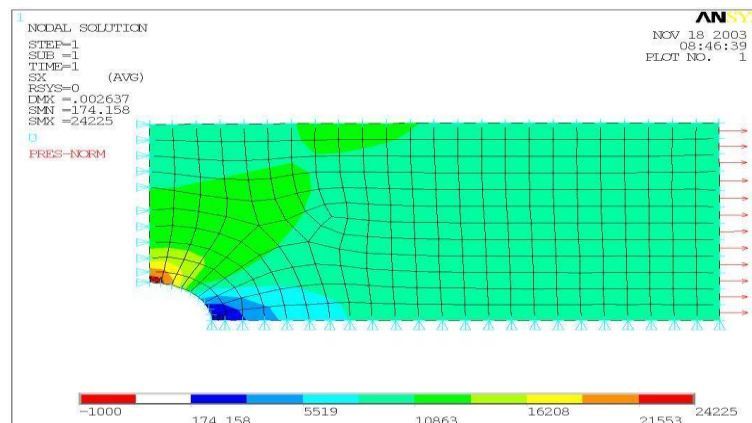
There are many, many other ways to look at your results data including:
• Listing them to a file.
• Querying with the mouse to find a result at a particular node.
• Graphing results along a path.
• Combining different load cases.
• Summing forces at a point.
• Extracting data and storing it an APDL array that you can do further operations.

Animate any result on the deformed shape with ―Utility Menu → Plot Ctrls → Animate‖. This is very helpful for understanding if your model is behaving in a reasonable way.

Experiment No: 1   **Date:**

Stress Analysis of Bars of Constant Cross Section Area

AIM:

To perform displacement and stress analysis for the given bar using Ansys simulation and analytical expressions.

Problem Description:

A steel rod subjected to tension is modeled by one bar element, as shown in figure. Determine the nodal displacements and the axial stress in each Element and reaction forces. E=2.1x 10^5 N/ mm^2, 0.3 (Poisson's Ratio).

Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

       File - Change Job name

       File - Change Title

Step 2: Ansys Main Menu –Preferences

       Select –STRUCTURAL - ok

Step 3: Preprocessor

       Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

       Real constants –Add –ok –Real constant set no –1 –c/s area –22/7*50**2/4 –ok.

       Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX – 2.1e5 –ok –close.

       Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –300, 0, 0 –ok (second node is Created).

       Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –ok (elements are Created through nodes).

Step 4: Solution

       Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs to be constrained –All DOF –ok.

       Define loads –Apply –Structural –Force/Moment –on Nodes - pick node 2 –Apply –

direction of For/Mom –FX –Force/Moment value –1500 (+ve value) –
ok. **Solve** –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–By data Sequence item'num–LS–LS1
–ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1
– Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Elem table Data –Items to be listed –LS1 –ok. (Stress will be
displayed with the element numbers)

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces
will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal
solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be
displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+ undeformed-ok

PlotCtrls – Animate – Deformed results – DOF solution – Displacement Vector sum
– ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys		Theoretical	
	Node 1	**Node 2**	**Node 1**	**Node2**
Deformation				
Stress				
Reaction				

Results:
The analysis of the bar was carried out using the Ansys simulation and the
software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increasing number of nodes and
elements to match the theoretical or analytical results.
Conclusions: Ansys simulation and the software results are near to theoretical or
analytical results.

Experiment No: 2   **Date:**
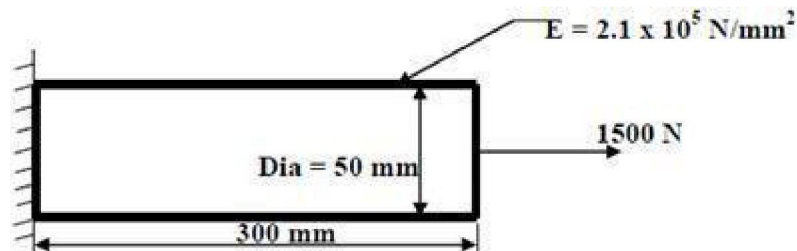
Stress Analysis of Bars of Constant Cross Section Area

AIM:

To perform displacement and stress analysis for the given bar using Ansys simulation and analytical expressions.

Problem Description:

A steel rod subjected to tension is modeled by one bar element, as shown in figure. Determine the nodal displacements and the axial stress in each Element and reaction forces. E=2.1x 10^5 N/ mm^2,0.3 (Poisson's Ratio).

Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

        File - Change Job name

        File - Change Title

Step 2: Ansys Main Menu –Preferences

        Select –STRUCTURAL - ok

Step 3: Preprocessor

        Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

        Real Constants –Add –ok –Real constant set no –1 –c/s area –22/7*60**2/4 –ok.

        Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX – 2.1e5 –PRXY –0.3 –ok –close.

        Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –450, 0, 0 –ok (second node is Created).

        Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –ok (elements are Created through nodes).

Step 4: Solution

        Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes- pick node 2 –Apply – direction of For/Mom –FX –Force/Moment value –2500 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1-ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Elem table Data –Items to be listed –LS1 –ok. (Stress will be displayed with the element numbers)

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok

PlotCtrls – Animate – Deformed results – DOF solution – Displacement Vector sum – ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys		Theoretical	
	Node 1	Node 2	Node 1	Node2
Deformation				
Stress				
Reaction				

Results:

The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increasing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 3   **Date:**
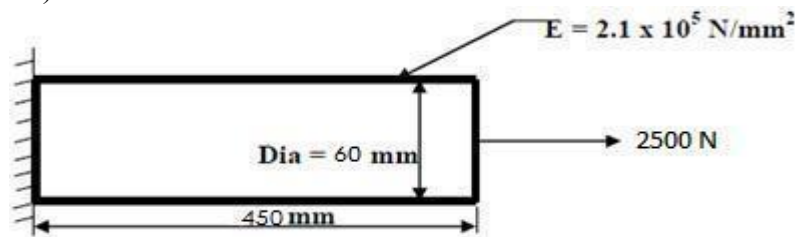
Stress Analysis of Bars of Constant Cross Section Area

AIM:

To perform displacement and stress analysis for the given bar using Ansys simulation and analytical expressions.

Problem Description:

A steel rod subjected to compression is modeled by two bar elements, as shown in figure. Determine the nodal displacements and the axial stress in each Element. E=207 GPa, A = 500 mm^2
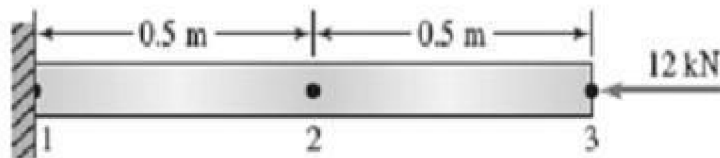
Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

      File - Change Job name

      File - Change Title

Step 2: Ansys Main Menu –Preferences

      Select –STRUCTURAL - ok

Step 3: Preprocessor

      Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

      Real constants –Add –ok –Real constant set no –1 –c/s area –500 –ok.

      Material Properties –Material models –Structural –Linear –Elastic –Isotropic –EX – 207e3 –ok –close.

      Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –500, 0, 0 –Apply (second node is Created) - x, y, z location in CS – 1000, 0, 0 (third node is Created).

      Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –Apply - pick 2 & 3 (elements are Created through nodes).

Step 4: Solution

Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes- pick node 3 –Apply – direction of For/Mom –FX –Force/Moment value –- 12000 (-ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1–ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.
Comparison between theoretical and Ansys values:

Particulars	Ansys			Theoretical		
	Node 1	Node 2	Node 3	Node 1	Node2	Node 3
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

**Experiment No: 4**   **Date:**

AIM:

To perform displacement and stress analysis for the given bar using Ansys simulation and analytical expressions.

Problem Description:

A load of P = 60 x 10^3 N is applied as shown. Determine the following, a) Nodal Displacement, b) Stress in each member, c) Reaction Forces.

Given Data: E=20 x10^3 N/mm^2 .0.3 (Poisson'sRatio)
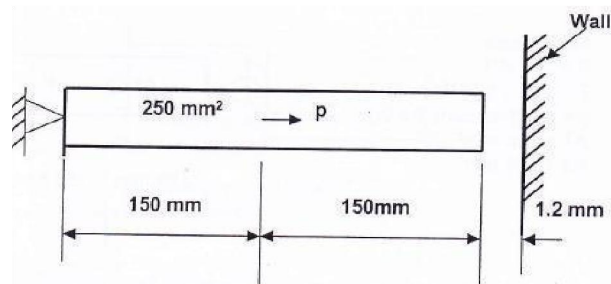
Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

    File - Change Job name

    File - Change Title

Step 2: Ansys Main Menu –Preferences

    Select –STRUCTURAL - ok

Step 3: Preprocessor

    Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

    Real Constants –Add –ok –Real constant set no –1 –c/s area –250 –ok.

    Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX – 20e3 –ok –close.

    Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –150, 0, 0 –Apply (second node is Created) - x, y, z location in CS –300, 0, 0 (third node is Created).

    Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –Apply - pick 2 & 3 (elements are Created through nodes).

Step 4: Solution

    Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs to be constrained –All DOF –ok.

    Define loads –Apply –Structural –Force/Moment –on Nodes- pick node 3 –Apply – DOFs to be constrained –UX –VALUE - Displacement Value –1.2 - ok.

Define loads –Apply –Structural –Force/Moment –on Nodes- pick node 2 –Apply – direction of For/Mom –FX –Force/Moment value –60e3 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1 –ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys			Theoretical		
	Node1	**Node2**	**Node3**	**Node1**	**Node2**	**Node3**
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increasing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 6   **Date:**

Stress Analysis of Bars of Tapered Cross Section Area

AIM:

To perform displacement and stress analysis for the given Taper bar using Ansys simulation and analytical expressions.

Problem Description:

For the tapered bar shown in the figure determine the displacement, stress and reaction in the bar. Given A_1 = 1000 mm^2 and A_2 = 500 mm^2, E = $2x10^5$ N/mm^2
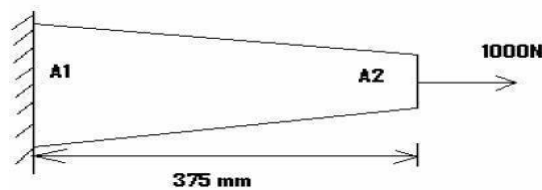
The Tapered bar is modified into 2 elements as shown below with modified area of cross section (1000+500)/2 = 750 mm^2

Areas of modified two elements:

A`$_1$= (1000+750)/2 = 875 mm^2

A`$_2$= (750+500)/2 = 625 mm^2
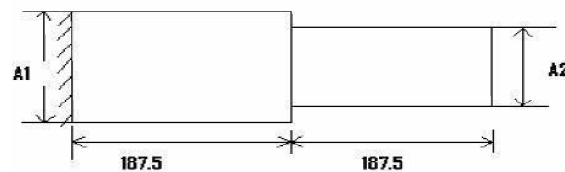
Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

   File - Change Job name

   File - Change Title

Step 2: Ansys Main Menu –Preferences

   Select –STRUCTURAL - ok

Step 3: Preprocessor

   Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

   Real constants –Add –ok –Real constant set no –1 –c/s area –875 –ok. Add –ok – Real constant set no –2 –c/s area 625– ok.

   Material Properties –Material models –Structural –Linear –Elastic –Isotropic –EX – 2e5 –ok –close.

   Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –187.5, 0, 0 –Apply (second node is Created) - x, y, z location in CS – 375, 0, 0

(third node is Created).

> **Modeling** –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –Apply -
> pick 2 & 3 (elements are Created through nodes).

Step 4: Solution

> **Define loads** –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs
> to be constrained –All DOF –ok.

> **Define loads** –Apply –Structural –Force/Moment –on Nodes- pick node 2 –Apply
> – direction of For/Mom –FX –Force/Moment value –1000 (+ve value) –ok.

> **Solve** –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

> **Element table** –Define table –Add –_Results–BydataSequence item'num–LS–LS1–ok.

> **Plot Results** –Deformed Shape –def+undeformed –ok.

> **Plot Results** –Contour plot –Line Element Results –Elem table item at node I –LS1
> – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

> **List Results** –Reaction Solution –items to be listed –All items –ok (reaction forces
> will be displayed with the node numbers).

> **List Results** –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal
> solution will be displayed with the node numbers).

> **List Results** –Nodal loads –items to be listed –All items –ok (Nodal loads will be
> displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.
 Comparison between theoretical and Ansys values:

Particulars	Ansys			Theoretical		
	Node1	**Node2**	**Node3**	**Node1**	**Node2**	**Node3**
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 7   **Date:**

Stress Analysis of Bars Varying In Cross Section or Stepped Bars

AIM:

To perform displacement and stress analysis for the given stepped bar using Ansys simulation and analytical expressions.

Problem Description:

Consider the stepped bar shown in figure below. Determine the nodal displacement stress in each element, reaction forces.
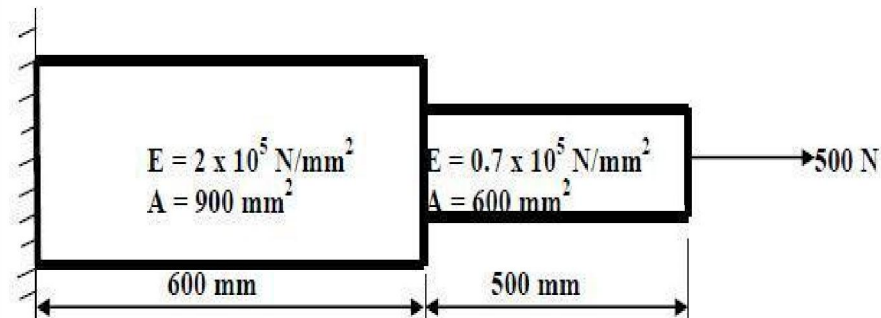
Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

       File - Change Job name

       File - Change Title

Step 2: Ansys Main Menu –Preferences

       Select –STRUCTURAL - ok

Step 3: Preprocessor

       Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok –close.

       Real constants –Add –ok –Real constant set no –1 –c/s area –900 –ok. Add –ok –
            Real constant set no –2 –c/s area 600–ok.

       Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX –
       2e5 –ok,

       Material –New model –Define material ID –2 –ok –Structural –Linear –Elastic
       – Isotropic –EX –0.7e5 –ok –close.

       Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z
       location in CS –600, 0, 0 –Apply (second node is Created) - x, y, z location in CS –
       1100, 0, 0 (third node is Created).

       Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –Apply -
       pick 2 & 3 (elements are Created through nodes).

 Step 4: Solution

Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 –Apply – DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes - pick node 3 –Apply – direction of For/Mom –FX –Force/Moment value –500 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1–ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys			Theoretical		
	Node1	**Node2**	**Node3**	**Node1**	**Node2**	**Node3**
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 8   **Date:**

AIM:

To perform displacement and stress analysis for the given stepped bar using Ansys simulation and analytical expressions.

Problem Description:

Find nodal displacement, stress in the element & reaction forces for the following problem. Given Data: E = 2x 10^5 N /mm^2, γ= 0.3 (Poisson's Ratio).A_1 = 40 mm^2 , A_2 = 20 mm^2
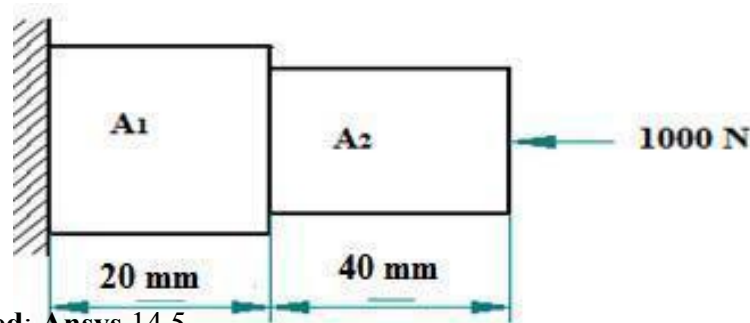
Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

      File - Change Job name

      File - Change Title

Step 2: Ansys Main Menu –Preferences

      Select –STRUCTURAL - ok

Step 3: Preprocessor

      Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

      Real constants –Add –ok –Real constant set no –1 –c/s area –40 –
                ok. Add –ok –Real constant set no –2 –c/s area
                – 20 –ok.

      Material Properties –Material models –Structural –Linear –Elastic –Isotropic –EX – 2e5 –ok - close

      Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –20, 0, 0 –Apply (second node is Created) - x, y, z location in CS – 60, 0, 0 (third node is Created).

      Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –Apply - pick 2 & 3 (elements are Created through nodes).

 Step 4: Solution

      Define loads –Apply –Structural –Displacement –on Nodes - pick node 1 –Apply –

DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes - pick node 3 –Apply – direction of For/Mom –FX –Force/Moment value –1000 (-ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1 –ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.

Particulars	Ansys			Theoretical		
	Node1	**Node2**	**Node3**	**Node1**	**Node2**	**Node3**
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
**Conclusion:** Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 9   **Date:**

AIM:

To perform displacement and stress analysis for the given stepped bar using Ansys simulation and analytical expressions.

Problem Description:

Find nodal displacement, stress in each element & reaction forces for the following problem Given Data: 1) $E_1 = 70 \times 10^3$ N/mm^2, $A_1 = 2400$ mm^2. 2) $E_2 = 200 \times 10^3$ N / mm^2, $A_2 = 600$ mm^2 ,$\gamma = 0.3$ (Poisson's Ratio)
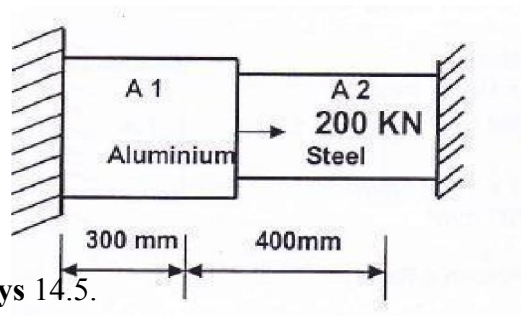
Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

    File - Change Job name

    File - Change Title

Step 2: Ansys Main Menu –Preferences

    Select –STRUCTURAL - ok

Step 3: Preprocessor

    Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

    Real constants –Add –ok –Real constant set no –1 –c/s area – 2400 –ok. Add –ok –Real constant set no –2 – c/s area –600 –ok.

    Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX – 70e3 –PRXY –0.3 - ok

    Material –New model –Define material ID –2 –ok –Structural –Linear –Elastic – Isotropic –EX –200e3 –PRXY –0.3 - ok –close.

    Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –300, 0, 0 –Apply (second node is Created) - x, y, z location in CS –700, 0, 0 (third node is Created).

    Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –ok Elements Attributes- Change Real Constant Set No 2 & Material No 2- Ok- Elements – Auto Numbered - Thru Nodes - Pick 2 & 3 Node-Apply-0k.

Step 4: Solution

Define loads –Apply –Structural –Displacement –on Nodes- pick node 1 & 3 –Apply –DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes- pick node 2 –Apply – direction of For/Mom –FX –Force/Moment value –200000 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Resultem's–BydataSequence inum –LS –LS1 –ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.
Comparison between theoretical and Ansys values:

Particulars	Ansys			Theoretical		
	Node1	**Node2**	**Node3**	**Node1**	**Node2**	**Node3**
Deformation						
Stress						
Reaction						

Results:
The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 10   **Date:**

AIM:

To perform displacement and stress analysis for the given stepped bar using Ansys simulation and analytical expressions.

Problem Description:

Consider the bar loaded as shown. Determine the following
1)Nodal displacement, 2)Stress in the element, 3)Reaction forces. Given Data: P = 300 KN, E = 200×10^9 N/m^2. $\gamma = 0.3$ (Poisson's Ratio) ,A$_1$ = 250 mm^2, A$_2$ = 400 mm^2
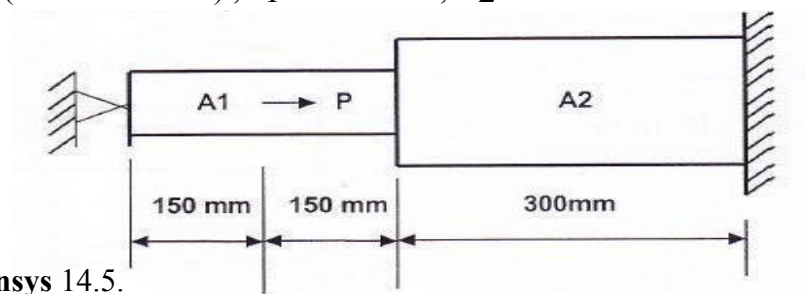
Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

  File - Change Job name

  File - Change Title

Step 2: Ansys Main Menu –Preferences

  Select –STRUCTURAL - ok

Step 3: Preprocessor

  Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

  Real Constants –Add –ok –Real constant set no –1 –c/s area
     –250 –ok Add –ok –Real constant set no –
     2 –c/s area –400 –ok

  Material Properties –Material Models –Structural –Linear –Elastic – Isotropic –EX – 200e3 –PRXY –0.3 - ok

  Modeling –Create –Nodes –In Active CS –Apply (first node is Created) – x, y, z location in CS –150, 0, 0 –Apply (second node is Created) - x, y, z location in CS –300, 0, 0 –Apply (third node is Created), x, y, z location in CS –600, 0, 0 –ok (fourth node is Created).

  Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 – Apply - pick 2 & 3 –ok.

  Modeling –Create –Elements –Element Attributes –Change Real Constant Set No 2 – ok - pick 3 & 4 (elements are Created through nodes).

Step 4: Solution

Define loads –Apply –Structural –Displacement –on Nodes - pick node 1 & 4 –Apply –DOFs to be constrained –All DOF –ok.

Define loads –Apply –Structural –Force/Moment –on Nodes - pick node 2 –Apply – direction of For/Mom –FX –Force/Moment value –300e3 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add –_Results–BydataSequence item'num–LS–LS1–ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

List Results –Reaction solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys				Theoretical			
	Node1	**Node2**	**Node3**	**Node4**	**Node1**	**Node2**	**Node3**	**Node4**
Deformation								
Stress								
Reaction								

Results:

The analysis of the bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

Experiment No: 11   **Date:**

AIM:

To perform displacement and stress analysis for the given stepped bar using Ansys simulation and analytical expressions.

Problem Description:

An axial load $P = 300 \times 10^3$ N is applied at 20 °C to the rod as shown. The temperature is raised to 60^0c. Determine the nodal displacement, stress in the element, reaction forces.

   Given Data:

   1: Aluminum: 2: Steel:

   $E = 70 \times 10^9$ N / m^2. $E = 200 \times 10^9$ N/m^2

   $\gamma = 0.3$ (Poisson'sRatio) $\gamma = 0.3$ (Poisson'sRatio)

   $A = 900$ mm^2 $A = 1200$ mm^2
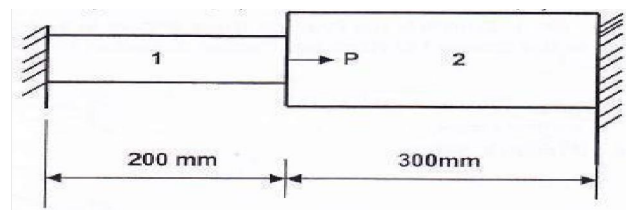
   $\alpha = 23 \times 10^{-6}$ °C $\alpha = 11.7 \times 10^{-6}$ °c

Software Required: **Ansys** 14.5.
Procedure:
Step 1: Ansys Utility Menu

   File - Change Job name

   File - Change Title

Step 2: Ansys Main Menu –Preferences

   Select –STRUCTURAL - ok
Step 3: Preprocessor

   Element type –Add/Edit/Delete –Add –Link –3D finit stn 180 –ok – close.

   Real constants –Add –ok –Real constant set no –1 –c/s area –900 –ok

         Add –ok –Real constant set no –2 –c/s area –1200 –ok –close.
   Material Properties –Material models –Structural –Linear –Elastic –Isotropic –EX – 70e3 –PRXY –0.3 –ok

   Thermal Expansion - Secant Coefficient - lsotropic - ALPX-23E-6 –ok.
   Material - Define material ID –2 –ok —Structural –Linear –Elastic –Isotropic –EX – 200e3 –PRXY –0.3 –ok

   Thermal Expansion-Secant Coefficient - lsotropic –ALPX -11.7E-6-Ok
   Modeling –Create –Nodes –In Active CS –Apply (first node is Created) –x, y, z location in CS –200, 0, 0 –Apply (second node is Created) - x, y, z location in CS –500, 0, 0 –Apply (third node is Created)

Modeling –Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –ok - Elements Attributes- Change Real Constant Set No 2 & Material No 2- Ok- Elements – Auto Numbered - Thru Nodes - Pick 2 & 3 Node -Apply- 0k.

Step 4: Solution

Define loads –Settings –Reference Temperature –20 - Ok.

Define Loads - Apply-Structural –Temperature - On Elements - Select Both Elements - Apply - VAL 1 Temperature at Location N = 60 –ok.

Define Loads - Apply - Structural - Displacement –On Nodes - Pick Node No 1 & 3 - Apply -All DOF -Apply - OK.

Define Loads –Apply –Structural - Force / Moments –On Nodes - Pick 2nd Node - Apply - Select FX = 300e3 - Apply - Ok.

Solve –Current LS –ok (Solution is done is displayed) –close**.**

Step 5: General Post Processor

Element table –Define table –Add – Results–BydataSequence item'num–LS–LS1–ok.

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –LS1 – Elem table item at node J –LS1 –ok (Line Stress diagram will be displayed).

Element Table - List Element Table - Select Stress - Ok.

List Results –Reaction Solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal Solution –DOF solution –Displacement Vector Sum –ok. (Nodal solution will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok.

Comparison between theoretical and Ansys values:

Particulars	Ansys				Theoretical			
	Node1	Node2	Node3	Node4	Node1	Node2	Node3	Node4
Deformation								
Stress								
Reaction								

Results:

The analysis of the stepped bar was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

DEPARTMENT OF MECHANICAL ENGINEERING

Verification/Validation: Verify the Ansys results by increasing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.

EXPT;11 Stress analysis of Beams

AIM:

Draw the shear force and bending moment diagrams for the given beam due to applied load .

Problem Description:

Compute the Shear force and bending moment diagrams for the beam shown. Assume rectangular c/s area of 0.2 m * 0.3 m, Young's modulus of 210 GPa, Poisson's ratio 0.27.

Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

> **File** - Change Job name
>
> **File** - Change Title

Step 2: Ansys Main Menu –Preferences

> **Select –STRUCTURAL -** ok

Step 3: Preprocessor

> **Element type** –Add/Edit/Delete –Add –BEAM –2 noded 188 –ok- close.
>
> **Material Properties** –Material Models –Structural –Linear –Elastic – Isotropic –EX – 210e3 –PRXY –0.27 –ok –close.
>
> **Sections** –Beam –Common Section –B = 200, H = 300 –ok.
>
> **Modeling** –Create –Nodes –In Active CS –Apply (first node is created) – x, y, z location in CS –5000, 0, 0 –ok (second node is Created).
>
> Create –Elements –Auto numbered –Thru Nodes –pick 1 & 2 –ok (elements are created through nodes).

Step 4: Solution

> **Define loads** –Apply –Structural –Displacement –on Nodes - pick node 1 – Apply – DOFs to be constrained –ALL DOF –ok.
>
> **Define loads** –Apply –Structural –Force/Moment –on Nodes - pick node 2 –Apply – direction of For/Mom –FY –Force/Moment value - -10000 (-ve value) –ok.
>
> **Solve** –Current LS –ok (Solution is done is displayed) –close.

 Step 5: General Post Processor

> **Plot Results** –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Nodal solu –DOF solution –displacement vector sum – ok.

Element table –Define table –Add –_Results–BydataSequence item'num–SMISC –SMISC, 6 –Apply, By Sequence num –SMISC –SMISC, 19 –Apply, By Sequence num – SMISC –SMISC, 2 –Apply, By Sequence num –SMISC –SMISC, 15 –ok – close.

NOTE: For Shear Force Diagram use the combination SMISC 6 & SMISC 19, for Bending Moment Diagram use the combination SMISC 3 & SMISC 16.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS6 –Elem table item at node J –SMIS19 –ok (Shear force diagram will be displayed).

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS2 –Elem table item at node J –SMIS15 –ok (bending moment diagram will be displayed).

List Results –reaction solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed results –DOF solution –USUM –ok.

Comparison b/w Theoretical & Ansys Results

Particulars	Ansys		Theoretical	
	Maximum	**Minimum**	**Maximum**	**Minimum**
Shear force				
Bending Moment				

Results:
The analysis of the cantilever Beam was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results.
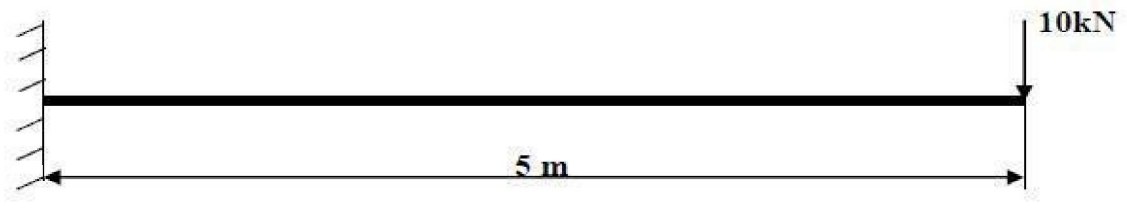
Experiment No: 12   **Date:**

Stress analysis of Beams

AIM:
Draw the shear force and bending moment diagrams for the given beam due to applied load.

Problem Description:

Compute the shear force and bending moment diagrams for the beam shown Assume rectangular c/s area of 0.2 m * 0.3 m, Young's modulus of 210 GPa, Poisson's ratio 0.27.

Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

      File - Change Job name

      File - Change Title

Step 2: Ansys Main Menu –Preferences

      Select –STRUCTURAL –ok

Step 3: Preprocessor

      Element type –Add/Edit/Delete –Add –BEAM –2 noded 188 –ok- close.

      Material Properties –Material Models –Structural –Linear –Elastic –Isotropic –EX – 210e3 –PRXY –0.27 –ok –close.

      Sections –Beam –Common Section –B = 200, H = 300 –ok.

      Modeling –Create –Keypoints –In Active CS –Apply (first node is Created) –x, y, z location in CS –2000, 0, 0 - Apply (second node is Created) –4000, 0, 0 –ok - (third node is Created).

      Modeling –Create –Lines –Straight lines–In Active Coord –pick keypoints 1 & 2, pick keypoints 2 & 3 –ok.

      Meshing –Size cntrls –Manual size –Global –Size –Element edge length –5 –ok.

      Meshing –Mesh –Lines –Pick all –ok.

Step 4: Solution

      Define loads –Apply –Structural –Displacement –on keypoint - pick keypoint 1 – Apply –DOFs to be constrained –UX, UY, UZ, ROTX, ROTY –Apply –pick keypoint 3 –Apply

–DOFs to be constrained –UY–ok.

Define loads –Apply –Structural –Force/Moment –on keypoint - pick keypoint 2 –
Apply –direction of For/Mom –FY –Force/Moment value –-20e3 (-ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Nodal solu –DOF solution –displacement vector sum -ok.

Element table –Define table –Add –_Results–BydataSequence item'num–SMISC

–SMISC, 6 –Apply, By Sequence num –SMISC –SMISC, 19 –Apply, By Sequence num

–SMISC –SMISC, 3 –Apply, By Sequence num –SMISC –SMISC, 16 –ok – close.

NOTE: For Shear Force Diagram use the combination SMISC 6 & SMISC 19, for Bending Moment Diagram use the combination SMISC 3 & SMISC 16.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS6
–Elem table item at node J –SMIS19 –ok (Shear force diagram will be displayed).

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS3–
Elem table item at node J –SMIS16 –ok (Bending moment diagram will be displayed). **List
Results** –reaction solution –items to be listed –All items –ok (Reaction forces will
be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed results –DOF solution –USUM –ok.

Comparison b/w Theoretical & Ansys Results

Particulars	Ansys		Theoretical	
	Maximum	Minimum	Maximum	Minimum
Shear force				
Bending Moment				

Results:
The analysis of the cantilever Beam was carried out using the Ansys simulation
and the software results were compared with theoretical or analytical results.
Verification/Validation: Verify the Ansys results by increaing number of nodes and
elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or
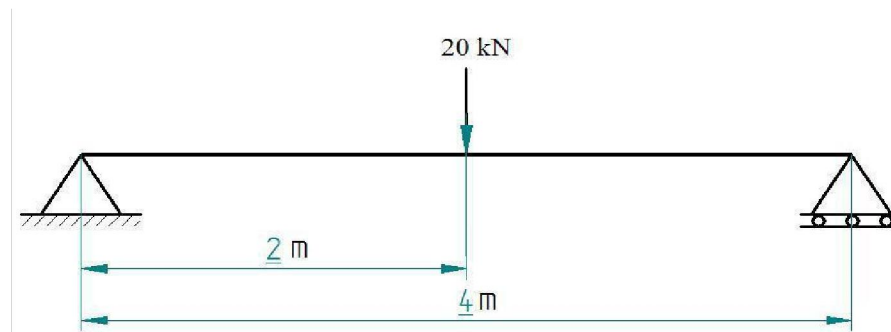analytical results.

Experiment No: 13   **Date:**

Stress analysis of Beams

AIM:

Draw the shear force and bending moment diagrams for the given beam due to applied load.

Problem Description:

Draw the shearforce and bending moment diagram for the beam loaded as shown in figure. Assume rectangular c/s area of 0.2 m * 0.3 m, E = 200GPa, Poisson's ratio = 0.3, Length (L) = 2m, q = 10kN/m.
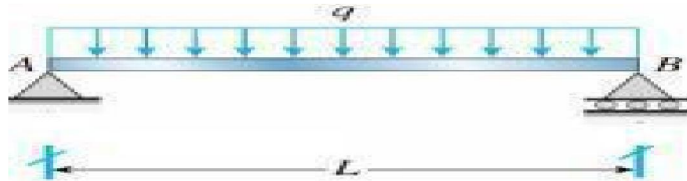
Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

       File - Change Job name

       File - Change Title

Step 2: Ansys Main Menu –Preferences

       Select –STRUCTURAL - ok

Step 3: Preprocessor

       Element type –Add/Edit/Delete –Add –BEAM –2 noded 188 –ok- close.

       Material Properties –Material models –Structural –Linear –Elastic – Isotropic –EX – 200e3 –PRXY –0.3 –ok –close.

       Sections –Beam –Common Section –B = 200, H = 300 –ok.

       Modeling –Create –Keypoints –In Active CS –Apply (first node is Created) –x, y, z location in CS –2000, 0, 0 –ok (second node is Created).

       Modeling –Create –Lines –Straight lines–in Active Coord –pick keypoints 1 & 2, pick ok.

       Meshing –Size Cntrls –Manual size –Global –Size –No of element divisions –100 –ok.

       Meshing –Mesh –Lines –Pick all –ok.

Step 4: Solution

       Define loads –Apply –Structural –Displacement –on keypoint - pick keypoint 1 – Apply –DOFs to be constrained –UX, UY, UZ, ROTX, ROTY –Apply – pick keypoint 2 –Apply –DOFs to be constrained –UY–ok.

Define loads –Apply –Structural –on beams –select full line –Load key –2 - Pressure value at node I –10e3 - ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Nodal solu –DOF solution –displacement vector sum –ok.

Element table –Define table –Add –_Results–BydataSequence item'num–SMISC

–SMISC, 6 –Apply, By Sequence num –SMISC –SMISC, 19 –Apply, By Sequence num – SMISC –SMISC, 3 –Apply, By Sequence num –SMISC –SMISC, 16 –ok – close.

NOTE: For Shear Force Diagram use the combination SMISC 6 & SMISC 19, for Bending Moment Diagram use the combination SMISC 3 & SMISC 16.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS6 –Elem table item at node J –SMIS19 –ok (Shear force diagram will be displayed).

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS3 –Elem table item at node J –SMIS16 –ok (bending moment diagram will be displayed).

List Results –reaction solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

List Results –Nodal loads –items to be listed –All items –ok (Nodal loads will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed results –DOF solution –USUM –ok.

Comparison b/w Theoretical & Ansys Results

	Ansys		Theoretical	
	Maximum	Minimum	Maximum	Minimum
Shear force				
Bending Moment				

Results:
The analysis of the Simply Supported Beam was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results

Experiment No: 14   **Date:**

Stress analysis of Beams

AIM:
Draw the shear force and bending moment diagrams for the given beam due to applied load.

Problem Description:

Draw the shear force and bending moment diagram for the beam loaded as shown in figure. Assume rectangular c/s area of 0.2 m * 0.3 m, E = 200GPa, Poisson's ratio = 0.3.

Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

      File - Change Job name

      File - Change Title

Step 2: Ansys Main Menu –Preferences

      Select –STRUCTURAL - ok

Step 3: Preprocessor

      Element type –Add/Edit/Delete –Add –BEAM –2 noded 188 –ok- close.

      Material Properties –Material models –Structural –Linear –Elastic – Isotropic –EX – 200e3 –PRXY –0.3 –ok –close.

      Sections –Beam –Common Section –B = 200, H = 300 –ok.

      Modeling –Create –Keypoints –In Active CS –Apply (first node is Created) –x, y, z location in CS –4000, 0, 0 - Apply (second node is Created) –6000, 0, 0 –ok - (third node is Created) - 8000, 0, 0 –ok - (fourth node is Created).

      Modeling –Create –Lines –Straight lines–in Active Coord –pick keypoints 1 & 2, pick keypoints 2 & 3, pick keypoints 3 & 4 –ok.

      Meshing –Size cntrls –Manual size –Global –Size –Element edge length –5 –ok.

      Meshing –Mesh –Lines –Pick all –ok.
Step 4: Solution

      Define loads –Apply –Structural –Displacement –on keypoint - pick keypoint 1 – Apply –DOFs to be constrained –UX, UY, UZ, ROTX, ROTY –Apply –pick keypoint 3 –Apply –DOFs to be constrained –UY–ok.

Define loads –Apply –Structural –Force/Moment –on keypoint - pick keypoint 4 – Apply –direction of For/Mom –FY –Force/Moment value –-20e3 (-ve value) –ok.

Define loads –Apply –Structural –on beams –select box option –select from

1st keypoint to 2nd –Load key –2 - Pressure value at node I –20e3 - ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Nodal solu –DOF solution –displacement vector sum –ok.

Element table –Define table –Add –_Results–BydataSequence item'num–SMISC

–SMISC, 6 –Apply, By Sequence num –SMISC –SMISC, 19 –Apply, By Sequence num –SMISC –SMISC, 3 –Apply, By Sequence num –SMISC –SMISC, 16 –ok – close.

NOTE: For Shear Force Diagram use the combination SMISC 6 & SMISC 19, for Bending Moment Diagram use the combination SMISC 3 & SMISC 16.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS6 –Elem table item at node J –SMIS19 –ok (Shear force diagram will be displayed).

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS3 –Elem table item at node J –SMIS16 –ok (bending moment diagram will be displayed).

List Results –Reaction solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed results –DOF solution –USUM –ok.
  Comparison b/w Theoretical & Ansys

	Ansys		Theoretical	
	Maximum	Minimum	Maximum	Minimum
Shear force				
Bending Moment				

Results: The analysis of the Simply Supported Beam was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results
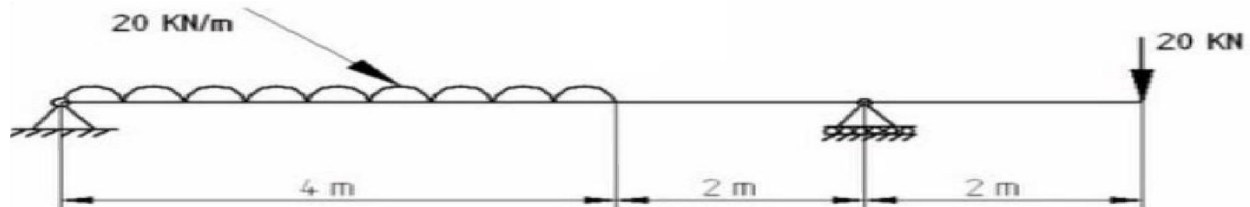
Experiment No: 15   **Date:**

Stress analysis of Beams

AIM:

Draw the shear force and bending moment diagrams for the given beam due to applied load.

Problem Description:

Draw the shear force and bending moment diagram for the beam loaded as shown in figure. Assume rectangular c/s area of 0.2 m * 0.3 m, E = 200GPa,

Poisson's ratio =   0.3.

Software Required: Ansys 14.5.

Procedure:

Step 1: Ansys Utility Menu

> File –clear and start new –do not read file –ok –yes.

Step 2: Ansys Main Menu –Preferences

> **Select –STRUCTURAL -** ok

Step 3: Preprocessor

> **Element type** –Add/Edit/Delete –Add –BEAM –2 noded 188 –ok- close.

> **Material Properties** –Material models –Structural –Linear –Elastic –Isotropic –EX – 200e3 –PRXY –0.3 –ok –close.

> **Sections** –Beam –Common Section –B = 200, H = 300 –ok.

> **Modeling** –Create –Keypoints –In Active CS –Apply (first node is Created) –x, y, z location in CS –2000, 0, 0 - Apply (second node is Created) –4000, 0, 0 –ok - (third node is Created) - 10000, 0, 0 –ok - (fourth node is Created).

> **Modeling** –Create –Lines –Straight lines–in Active Coord –pick keypoints 1 & 2, pick keypoints 2 & 3, pick keypoints 3 & 4 –ok.

> **Meshing** –Size cntrls –Manual size –Global –Size –No of element divisions –100 –ok.

> **Meshing** –Mesh –Lines –Pick all –ok.

Step 4: Solution

> **Define loads** –Apply –Structural –Displacement –on keypoint - pick keypoint 1 – Apply –DOFs to be constrained –UX, UY, UZ, ROTX, ROTY –Apply –pick keypoint 4 –Apply –DOFs to be constrained –UY–ok.

> **Define loads** –Apply –Structural –Force/Moment –on keypoint - pick keypoint 2 –

Apply –direction of For/Mom –FY –Force/Moment value –-20e3 (-ve value) –ok.

Define loads –Apply –Structural –on beams –select box option –select from 1st keypoint to 2nd –Load key –2 - Pressure value at node I –0 - Pressure value at node J –5e3 - ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Plot Results –Deformed Shape –def+undeformed –ok.

Plot Results –Contour plot –Nodal solu –DOF solution –displacement vector sum –ok.

Element table –Define table –Add –_Results–BydataSequence item'num–SMISC –SMISC, 6 –Apply, By Sequence num –SMISC –SMISC, 19 –Apply, By Sequence num –SMISC –SMISC, 3 –Apply, By Sequence num –SMISC –SMISC, 16 –ok – close.

NOTE: For Shear Force Diagram use the combination SMISC 6 & SMISC 19, for Bending Moment Diagram use the combination SMISC 3 & SMISC 16.

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS6 –Elem table item at node J –SMIS19 –ok (Shear force diagram will be displayed).

Plot Results –Contour plot –Line Element Results –Elem table item at node I –SMIS3 –Elem table item at node J –SMIS16 –ok (bending moment diagram will be displayed).

List Results –reaction solution –items to be listed –All items –ok (reaction forces will be displayed with the node numbers).

Step 6: PlotCtrls –Animate –Deformed results –DOF solution –USUM –ok.

Comparison b/w Theoretical & Ansys Results

	Ansys		Theoretical	
	Maximum	Minimum	Maximum	Minimum
Shear force				
Bending Moment				

Results:
The analysis of the Simply Supported Beam was carried out using the Ansys simulation and the software results were compared with theoretical or analytical results.

Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.

Conclusion: Ansys simulation and the software results are near to theoretical or analytical results
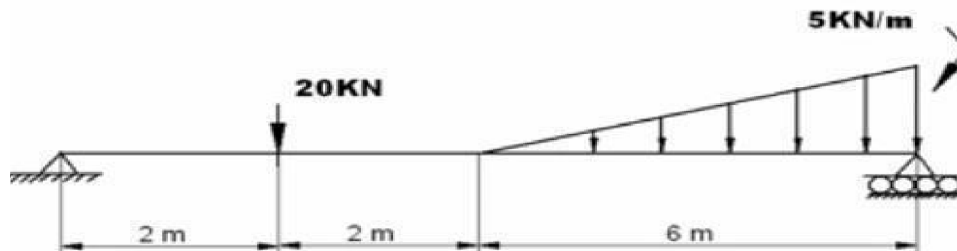
Stress Analysis of a Rectangular Plate with a circular Hole

AIM:

To determine the stress acting on a rectangular plate with a circular hole due to the applied external load.

Problem Description:

In the plate with a hole under plane stress, find deformed shape of the hole and determine the maximum stress distribution along A-B. E = 210GPa, t = 1 mm, Poisson's0.3,
Diameter of the circle =10 mm.
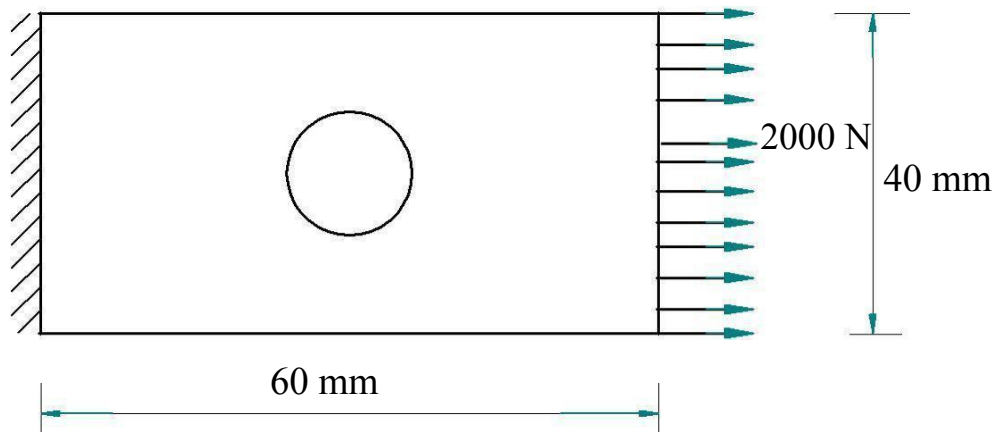
Software Required: **Ansys** 14.5.

Procedure:

Step 1: Ansys Utility Menu

> **File** - Change Job name
>
> **File** - Change Title

Step 2: Ansys Main Menu –Preferences

> **Select –STRUCTURAL –ok**

Step 3: Preprocessor

> **Element type** –Add/Edit/Delete –Add –Solid –Quad 4 node 182 –ok –Option – element behavior K3 –Plane stress with thickness –ok –close.
>
> **Real constants** –Add –ok –Real constant set no –1 –Thickness –1 –ok.
>
> **Material Properties** –material models –Structural –Linear –Elastic –Isotropic –EX – 210e3 –PRXY –0.3 –ok –close.

Modeling –Create –Area –Rectangle –by dimensions –X1, X2, Y1, Y2 –0, 60, 0, 40 –ok.

Modeling –Create –Area –Circle –solid circle –X, Y, radius –30, 20, 5 –ok.

Modeling –Operate –Booleans –Subtract –Areas –pick area which is not to be deleted (rectangle) –Apply –pick area which is to be deleted (circle) –ok.
Meshing –Mesh Tool –Mesh Areas –Quad –Free –Mesh –pick all –ok.
Meshing –Mesh Tool –Refine–pick all –Level of refinement –3 –ok.

Step 4: Solution

Define loads –Apply –Structural –Displacement –on Nodes –select box –drag the left side of the area –Apply –DOFs to be constrained –ALL DOF

Define loads –Apply –Structural –Force/Moment –on Nodes –select box –drag the right side of the area –Apply –direction of For/Mom –FX –Force/Moment value – 2000 (+ve value) –ok.

Solve –Current LS –ok (Solution is done is displayed) –close.

Step 5: General Post Processor

Plot Results –Deformed Shape –def+undeformed –ok.

Plot results –Contour plot –Element solu –Stress –Von Mises Stress –ok (the stress distribution diagram will be displayed).

Step 6: PlotCtrls –Animate –Deformed shape –def+undeformed-ok

Result: Thus the performance of the stress analysis of a Rectangular Plate with a circular hole was analyzed and animated.
Verification/Validation: Verify the Ansys results by increaing number of nodes and elements to match the theoretical or analytical results.
Conclusion: Ansys simulation and the software results are near to theoretical or analytical results

	Course Title: **AUTOMOBILE ENGINEERING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME63A**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Elective**

Prerequisites: Knowledge of Science, Work shop technology, Thermal engineering, Mechanics of Machines, EM & SOM.

Course Objectives:

To understand & apply the knowledge about various system, subsystems & their inter-relationships of the automobile for the manufacturing of advanced automotive techniques

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	CL	Linked PO	Teaching Hrs
CO1	Know the different types of automobiles, basic structure of automobile and their manufacturers in India. Understand the basic engine system working	*R/U/A*	2	**10**
CO2	Understand the transmission of power in automobile	*R/U/A*	2	**10**
CO3	Familiarise with fuel supply to automobile and understand the cooling system	*R/U/A*	2	**08**
CO4	Explain the steering and braking system employed in automobiles	*R/U/A*	2	**08**
CO5	Explain the different suspension system of an automobile and selection of tyre for an automobile	*R/U/A*	2	**10**
CO6	Explain the Electrical and ignition system employed in Automobile	*R/U/A*	2	**06**
		Total sessions		**52**

Legend: R; Remember, U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
AUTOMOBILE ENGINEERING	0	3	0	0	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If >40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	AUTOMOBILE ENGINE SYSTEM	10	5	15	10	30	20.68
2	TRANSMISSION SYSTEM	10	5	15	10	30	20.68
3	FUEL SYSTEMS & COOLING SYSTEM	08	5	10	-	15	10.34
4	CONTROL SYSTEM	08	5	5	10	20	13.81
5	SUSPENSION SYSTEMS, WHEELS & TYRES	10	5	10	10	30	20.68
6	AUTOMOBILE ELECTRICAL SYSTEMS	06	5	5	10	20	13.81
	Total	52	30	65	50	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: AUTOMOBILE ENGINE SYSTEM   10 HRS

Automobile-definition, types of auto mobiles-Major components of automobile-functions of automobile components-manufacturer of motor vehicles in India- automotive vehicles and their historical development. Engine -Main parts of engine-Cylinder block- Cylinder head-Piston- Connecting rod- Crank shaft- Crankcase- Cam shaft- Flywheel-Engine maintenance-dis-mounting of engine-Engine disassembly-Inspection of engine components-engine reassembly

UNIT II: TRANSMISSION SYSTEM   10 HRS

Clutch- Main parts-types of clutch- construction & working of Single plate clutch - diaphragm spring type clutch-Gear Box- Types of Gear box-construction & working of Sliding mesh Gear box-synchromesh Gear box-Constant mesh Gear box, Transmission devices- Torque converter, Overdrive, Final drive- Propeller shaft, Universal Joint - Differential-necessity-construction & working- Axle- Types of rear axle, front axle & their applications- Automatic Transmission System.

Directorate Of Technical Education   Karnataka StateMECH 15ME63A

UNIT III: FUEL SYSTEMS & COOLING SYSTEM   08 HRS

Fuel supply system for petrol engine- Carburettor-Simple carburettor- fuel pump- AC Mechanical pump-SU Electrical pump- DTSI (Digital Twin Spark Ignition System)

Fuel injection for diesel engine-Fuel injection pump- - microprocessor based fuel injection system- CRDI (Common Rail Direct Injection) System.

Engine lubrication systems- High pressure Lubrication system- Petroil System

Engine cooling system -The necessity of cooling system - Types of cooling system-air cooling and water cooling. Types of water cooling system –Thermosyphon system and pump circulation system. Advantages and disadvantages of air cooling and water cooling systems. The components of water cooling system

UNIT IV: CONTROL SYSTEM   08 HRS

Steering system- Functions & Requirement of steering system. Construction and working of steering linkage. Steering gear box –Rack & Pinion Steering mechanism-Power steering - steering geometry- camber, caster, toe-in, toe-out, Kingpin inclination & their effects. Brake system- Types of brakes- Internal expanding brake - Disc brake- Hydraulic Brake.- Anti-lock braking system(ABS)

UNIT V: SUSPENSION SYSTEMS, WHEELS & TYRES.   10 HRS

Suspension system-Need for good suspension system-elements of suspension system-Leaf Springs-Helical Springs - Construction & working of McPherson & wishbone type –Air Suspension System- Construction & working of Telescopic shock absorbers-Types of Automobile wheels, their construction & working- essential requirements of wheels - Construction, working & comparison of radial, cross-ply and tubed, tubeless tyre -Tyre specifications-Factors affecting tyre life-Wheel Alignment and Balancing

UNIT VI: AUTOMOBILE ELECTRICAL SYSTEMS   06 HRS

Auto electric system-main components of auto electric system-Ignition system- construction & working of electronic ignition system-Battery ignition system- Magneto ignition system, Starting system- Charging system.

Lighting system - Power door locks features- Smart Wiper Control System - Air bags features used in automobiles.

TEXT BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Automobile Engineering	Kirpal Singh	Standard Publication
2.	Automobile Engineering. (Developed at NITTTR,Bhopal)	K.K.jain R.B.Asthana	Mcgraw Hill
3.	Automobile Engineering	R.B.Guptha	-
4	Automobile Mechanics	William Crouse	Tata Mcgraw hill
5	Automotive Mechanics	Joseph Hitner	
6	Automobile Engineering	G.S.Narang	Khanna publishers

1. , LIST OF SOFTWARES/ LEARNING WEBSITES:

      i. http://nptel.ac.in/courses/112105051/

      ii download other power plant related videos from youtube.com for study purpose.

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	**AUTOMOBILE ENGINE SYSTEM**	lectures and Power point presentations/ Video/ Video movies
2	**TRANSMISSION SYSTEM**	Lectures/Presentations, Showing charts, Industrial visits to Automobile work shops
3	**FUEL SYSTEMS & COOLING SYSTEM**	Lectures/Presentations, Showing charts, Industrial visits to Automobile work shops
4	**CONTROL SYSTEM**	Lectures/Presentations, Showing charts, Industrial visits to Automobile work shops
5	**SUSPENSION SYSTEMS, WHEELS & TYRES**	Lectures/Presentations, Showing chart,
6	**AUTOMOBILE ELECTRICAL SYSTEMS**	Lectures/Presentations, Showing charts, Industrial visits to Automobile work shops

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Prepare list of various major automobile manufacturers of Two wheeler sand fourwheelers in India, along with their specification
2	Prepare report on Top 10 Car/MUV/2W/Heavy vehicle Manufacturers in India & their sale in last 2 Years.
3	Collect the detail specification on Top 5 models of Car Manufactured in India
4	Download technical specifications/ catalogues, videos or any other suitable presentations on Automobile engines used in four wheelers
5	Download technical specifications/ catalogues, videos or any other suitable presentations on Automobile tyres/Power steering/Suspension system
6	Visit to four- wheeler service station & any automobile manufacturing unit. Prepare hand written report on aspects they observed in service station

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	**VI SEM** Year: 2016-17	**AUTOMOBILE ENGG** Course code:**15ME63A**	20

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	a. Name the manufacturers of motor vehicles in India. b. List the functions of piston rings	**5**	**R**	**1**	2
2	Explain with sketch compression ring and oil control rings	**5**	**U**	**1**	2
3	Explain the Automatic Transmission System	**5**	**U**	**2**	2
4	Identify the role of Automatic Transmission system in automobile industry.	**5**	**A**	**2**	2

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. Define piston and List its functions
2. Explain the construction and functions of cylinder block
3. Compare between live axle and dead axle
4. Explain torque convertor with a neat sketch
5. Compare between water cooling and air cooling system
6. What are the requirements of steering mechanism
7. List the factors affecting the tyre life.
8. List the types of lights used in automobiles.
9. Explain the working of Battery ignition system with a neat sketch.

PART-B   7x10=70 marks

1. a) List the functions of cylinder head gasket.
    b) Explain the construction and working of piston
2. Select the different steps for dismounting of the engine.
3. a) Explain front axle and mention its applications
    b) Explain the Automatic Transmission System
4. Explain synchromesh Gear box with a neat sketch
5. a) Explain with sketch the construction and working principle of simple carburettor
    b) Explain CRDI System
6. Identify the necessity of the steering geometry with diagrams
7. a) Explain telescopic shock absorbers with a neat sketch
    b) Explain the elements of suspension system

8. Identify the importance of wheel alignment and balancing in a vehicle
9. Develop a Block diagram of Auto electrical system and explain.
10. Explain the working of SU Electrical pump with a neat sketch
    .
****

Diploma in Mechanical Engineering
VI Semester
Course title: AUTOMOBILE ENGG

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO1: know the different types of automobiles, basic structure of automobile and their manufacturers in india. Understand the basic engine system working

REMEMBERING

1. List the types of automobiles.
2. Name the manufacturers of motor vehicles in India.
3. List the main components of an engine
4. What is the importance of cylinder liners in an engine.
5. Name the different types of gaskets used in automobile engines
6. Define piston and mention its functions
7. List the functions of piston rings
8. What is the purpose of camshaft in an engine.
9. What is the importance of flywheel in an engine.
10. List the steps to be followed for engine disassembly
11. List the causes for reboring a cylinder.

UNDERSTANDING

1. Explain the automotive vehicles and their historical development.
2. Explain the construction and functions of cylinder block.
3. Explain the dry liners with sketch.
4. Explain with the wet liners sketch.
5. Compare between dry liners and wet liners.
6. Explain crankcase with a neat sketch.
7. Explain with sketch the cylinder head.
8. Explain the functions of cylinder head gasket.
9. Explain the construction and working of piston
10. Explain with sketch compression ring and oil control rings
11. Explain with sketch connecting rod
12. Explain the functions of a crank shaft with a neat sketch
13. Explain engine maintenance.

APPLICATION

1. Identify the main components used in an automobile.
2. Identify the functions of major components used in automobile engine.

3. Select the different steps for safe dismounting of the engine.

REMEMBERING
1. What is the purpose of Clutch.
2. List the types of Clutches.
3. List the different types of gear boxes.
4. List the functions of Clutches
5. What is overdrive unit.
6. List the advantages of overdrive unit.

UNDERSTANDING

1. Explain the working of single plate clutch with a neat sketch.
2. Explain the diaphragm spring type clutch with a neat sketch.
3. Explain the working of Sliding mesh Gear box with a neat sketch
4. Explain the working of synchromesh Gear box with a neat sketch
5. Explain torque convertor with a neat sketch.
6. Explain final drive with its purpose.
7. Explain universal joints with its purpose
8. Explain Propeller shaft with its necessity.
9. Explain differential with a neat sketch.
10. Explain front axle and mention its applications
11. Explain the Automatic Transmission System.
12. Compare between live axle and dead axle.
13. Explain different types of rear axle with sketches.

APPLICATION
1. Identify the importance of spring type clutch with a neat sketch.
2. Identify the role of synchromesh Gear box to control speed with a neat sketch.
3. Identify the role of Automatic Transmission system in automobile industry.
4. Identify the necessity of overdrive unit in transmission system.

CO3: Familiarise with fuel supply to automobile and understand the cooling system

REMEMBERING

1. List the properties of air-fuel mixture
2. Define engine lubrication system and list its types.
3. Define engine cooling system and list its types.
4. List the parts of cooling system.
5. List the properties of Lubricating oil.

1. Explain Fuel system for petrol engine with block diagram (Layout).
2. Explain the working of AC Mechanical pump with a neat sketch.
3. Explain the working of SU Electrical pump with a neat sketch.
4. Explain with sketch the construction and working principle of simple carburettor.
5. Explain Fuel system for petrol engine with block diagram (Layout).
6. Explain fuel injection pump for diesel engine with sketch.
7. Explain DTSI System.
8. Explain CRDI System.
9. Explain water cooling system with sketch.
10. Explain air cooling system with sketch.
11. Compare between water cooling and air cooling system.

APPLICATION

1. Identify the importance of microprocessor based fuel injection system.
2. Develop a line diagram for fuel supply system for petrol engine.

CO4: Explain the steering and braking system employed in automobiles

REMEMBERING

1. List the functions of steering mechanism.
2. What are the requirements of steering mechanism.
3. Define a)Camber, b)Caster, c)Toe-in, d)Toe-out, e)Kingpin inclination
4. List the types of brakes.

UNDERSTANDING

1. Explain Construction and working of steering linkage with a neat sketch.
2. Explain Construction and working of steering gear box with a neat sketch.
3. Explain Construction and working of rack and pinion Steering mechanism with a neat sketch
4. Explain Construction and working of Power Steering mechanism with a neat sketch
5. Explain Construction and working of Drum brake with a neat sketch
6. Explain Construction and working of internal expanding brake with a neat sketch
7. Explain Construction and working of disc brake with a neat sketch
8. Explain Construction and working of Hydraulic Brake with a neat sketch
9. Explain Anti-lock braking system.
10. Compare Disc brake & drum brake.

APPLICATION
1. Identify the necessity of the steering geometry with diagrams.
2. Identify the role of steering linkage in steering mechanism.

REMEMBERING
1. List the elements of suspension system.
2. List the types of Automobile wheels.
3. List the essential requirements of wheels.
4. List the factors affecting the tyre life.

UNDERSTANDING
1. Explain the elements of suspension system.
2. Explain leaf spring with a neat sketch.
3. Explain Coil spring with a neat sketch.
4. Explain telescopic shock absorbers with a neat sketch
5. Explain pressed steel disc wheels
6. Explain telescopic Wire spoke wheels.
7. Explain telescopic Cast light alloy wheels.
8. Explain radial tyre.
9. Explain cross-ply tyre.
10. Explain tubed tyres.
11. Explain tubeless tyres.

APPLICATION
1. Identify the importance of a suspension system in a vehicle.
2. Making use of a sketch explain McPherson suspension system.
3. Making use of a sketch explain wishbone suspension system.
4. Identify the importance of wheel alignment and balancing in a vehicle.

CO6: Explain the electrical and ignition system employed in automobile

REMEMBERING

1. List the main components of Auto electrical system.
2. List the types of lights used in automobiles.

UNDERSTANDING

1. Explain the working of electronic ignition system with a neat sketch.
   2. Explain the working of Battery ignition system with a neat sketch
   3. Explain the working of Magneto ignition system with a neat sketch
   4. Explain Starting system.
   5. Explain Charging system.
   6. Explain Power door locks features used in automobile system.
   7. Explain Smart Wiper Control System used in automobile system
   8. Explain Air bags features used in automobiles.

APPLICATION

   1. Develop a Block diagram of Auto electrical system and explain.
   2. Identify the importance of air bags in an automobile.

	Course Title: **POWER PLANT ENGINEERING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME63B**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Elective**
CIE: 25 Marks			SEE:100 Marks

Prerequisites: Knowledge of Mathematics, Thermodynamics, Mechanics of machines, Work shop technology, Fluid mechanics and machinery.

Course Objectives:

Apply knowledge of mechanical engineering related to power generation systems, their control and economics in different type of power plants for their operation and maintenance.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Analyze economics of power plants and list factors affecting the power plants and interpret the performance of power plants based on load variations	*R/U*	2	**05**
CO2	Identify elements and their functions of, hydro power plants.	*R/U/A*	2	**10**
CO3	Identify elements and their functions and operations of steam power plants.	*R/U/A*	2	**10**
CO4	Identify elements and their functions and operations of nuclear and gas turbine power plants	*R/U/A*	2	**10**
CO5	Identify elements and their functions and operations of Solar, wind and diesel power plants	*R/U/A*	2	**09**
CO6	Know the Social and Economical issues of power plants	*R/U*	2,5,6,7	**08**
		Total sessions		**52**

Legend: R: Remember U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
POWER PLANT ENGINEERING	0	3	0	0	1	1	1	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	**INTRODUCTION & ECONOMICS OF POWER PLANT**	05	5	5	-	10	7
2	**HYDRO POWER PLANT**	10	5	10	15	30	21
3	**THERMAL POWER PLANT**	10	5	10	10	25	17
4	**NUCLEAR POWER PLANT & GAS TURBINE POWER PLANTS**	10	10	10	10	30	21
5	**SOLAR, WIND AND DIESEL POWER PLANTS.**	09	5	15	10	30	21
6	**PLANT SAFETY AND ENVIRONMENTAL IMPACT OF POWER PLANT**	08	5	15	-	20	13
	Total	52	35	65	45	145	100

Legend: R; Remember, U: Understand A: Application

UNITI: INTRODUCTION & ECONOMICS OF POWER PLANT   5 Hrs

Power plant-Introduction, Classification - Location of power plant- Choice of Power plant- Terminology used in power plant: Peak load, Base load, Load factor, Load curve, demand factor- Various factor affecting the operation of power plant- Load sharing- cost of power- tariff methods-factors involved in fixing of a tariff.

UNIT II: HYDRO POWER PLANT   09 HRS

Hydro electric power plant- Introduction, storage and poundage, Selection of sites for hydro electric power plant-General layout and essential elements of Hydro electric power plant and its working-Classification of the plant- base load plant, peak load plant, Run off river plant, storage river plant, pumped storage plant, mini and micro hydel plants, governing of

hydraulic turbines-impulse turbine- reaction turbine, selection of turbines, Advantages and disadvantages-limitations of hydro electric power plant.

UNT III: THERMAL POWER PLANT   11 HRS

Thermal power plant -General layout – working-Site Selection–materials required for thermal power plants, coal handling and its methods, stages in coal storage, Fuel burning-Stoker firing-overfeed stoker –under feed stokers-chain grate stoker, Pulverized fuel handling system-unit and central system, Pulverization of coal-Ball mill, Ash handling system- Gravity system- electrostatic precipitation (ESP) system-Feed water treatment- Mechanical method, Advantages and disadvantages-limitations of Thermal power plant.

UNITIV: NUCLEAR POWER PLANT & GAS TURBINE POWER PLANTS   10 HRS

Nuclear power plant-introduction-nuclear fuels, nuclear fission and fusion, working of a nuclear power plant, types of reactors- pressurized water reactor- boiling water reactor, effects of nuclear radiation, different methods for nuclear waste disposal-low, medium and high level waste disposal, Advantages -disadvantages- limitations.

 Gas turbine power plant- Schematic diagram & working of open and closed cycle gas turbine power plant, Components of Gas turbine–compressor, combustion chamber, gas turbine, vortex blading, gas turbine fuels, Gas turbine power plants in India - Namrup & Uran gas turbine power plants. Advantages -disadvantages- limitations of Gas turbine power plant

UNITV: SOLAR, WIND AND DIESEL POWER PLANTS.   9 HRS

Solar power plant-introduction-layout, Solar cell fundamentals & classification – maximum power point tracker (MPPT) and solar panel.
Wind power plant: introduction, -Factors affecting distribution of Wind energy, Variation of wind speed with height and time-Horizontal axis wind turbine (HAWT)-types of rotors- Vertical axis wind turbine- types of rotors- Wind energy conversion system (WECS) advantages and disadvantages-limitations of Wind power plant.
 Diesel power plant- layout -Components and the working- Advantages -disadvantages- limitations.

UNIT VI: PLANT SAFETY AND ENVIRONMENTAL IMPACT OF POWER PLANT
                                                                          08 Hrs

 Social and Economical issues of power plant- Oxides of sulphur- oxides of carbon-oxides of nitrogen, Acid precipitation-Acid rain- acid snow- Dry deposition-acid fog, green house effect, air and water pollution from thermal power plants and its control, Thermal pollution from thermal power plants, noise pollution and its control, natural and artificial radio activity-nuclear power and environment- radiations from nuclear power plant effluents- high level wastes- methods to reduce pollution, global warming- its effects and control, standardization for environmental pollution.

TEXT BOOKS AND REFERENCE BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Power plant engineering	Arora and Domkundwar	Dhanpat rai & CO (P) LTD
2.	Power plant engineering	P. K. Nag	McGraw Hill
3.	Power plant engineering	G. R. Nagpal	Khanna publishers
4.	Power Plant Engineering.	Dr. P. C. Sharma	S. K. Kataria
5.	A Text Book of Power Plant Engineering.	R K Rajput	Laxmi Publications,
6	Power plant technology	M.M. EL-Wakil	McGraw Hill
7	Power Plant Engineering.	C. Elanchezhian, L. Saravanakumar, B. Vijaya Ramnath	I.K. International Publishing House
8	Power Station Engineering and Economy.	Bernhardt G A Sarotzki, William A Vopat	Tata Mc Graw Hill
9	Nuclear Power Plant Engineering.	James H. Rust	Haralson Publishing Company
10	Steam power plant engineering.	Louis Allen Harding	J. Wiley & Sons, inc
11	Power Plant Engineering	A K Raja, Amit Prakash Srivastava and Manish Dwivedi	New age international Publishers

LIST OF SOFTWARES/ LEARNING WEBSITES:

i. http://nptel.ac.in/courses/112105051/

ii. https://www.youtube.com/watch?v=Ota2_LUuar0

iii. https://www.youtube.com/watch?v=Ota2_LUuar0

iv. https://www.youtube.com/watch?v=3dJAtHaSQ98

v. https://www.youtube.com/watch?v=xokHLFE96h8

vi. http://www.tatapower.com/businesses/renewable-energy.aspx

vii. http://www.cleanlineenergy.com/technology/wind-and-solar

viii. https://www.youtube.com/watch?v=kbuLfXgw4Gs

ix. https://www.youtube.com/watch?v=r9q80sSHxKM

x. https://www.youtube.com/watch?v=GZKKWz_tX1c

xi. download other power plant related videos from youtube.com for study purpose .

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	**Introduction & economics of power plant**	Videos, Presentations, Discussions
2	**Hydro power plant**	Videos, Presentations, Industrial Visits, Demonstration,
3	**Thermal power plant**	Videos, Presentations, Industrial Visits, Demonstration,
4	**Nuclear power plant & gas turbine power plants**	Videos, Presentations, Industrial Visits, Demonstration
5	**Solar, wind and diesel power plants.**	Videos, Presentations, Industrial Visits, Demonstration,
6	**Plant safety and environmental impact of power plant**	Videos, Presentations, Industrial Visits, Demonstration,

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)
- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Prepare list of various major power plants installed in Karnataka along with their total capacity.
2	Prepare charts of different high pressure boilers, gas turbine cycles, steam turbine power plant, wind turbine power plant, solar power plant, etc. on half imperial drawing sheet. Attach the same with term work.
3	Visit websites of NTPC, BHEL,, NHPC, NPCIL, GEDA, SUZLON, GE, SIEMENS, ENERCON and KPC etc and find out the technical information about their machineries or Plants.
4	Download technical specifications/ catalogues, videos or any other suitable presentations on gas turbine power plant
5	Download technical specifications/ catalogues, videos or any other suitable presentations on Hydro power plant.
6	Visit diesel power plant available in your institute/ nearer to your institute and understand different elements, working, circuits, and specifications.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

RUBRICS MODEL

	RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
	Average / Total marks=(4+5+3+2)/4=14/4=3.5=4					

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
4. Blue books (20 marks)
5. Student suggested activities report for 5 marks
6. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method

Test/Date and Time	Semester/year	Course/Course Code		Max Marks
Ex: I test/6 th week of sem 10-11 Am	IVSEM	POWER PLANT ENGINEERING		20
	Year: 2016-17	Course code:15ME63B		

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	List the various factors considered for location of power plants OR Explain a) Peak load b) Base load	05	R	1	2
2	Explain load sharing.	05	U	1	2
3	Explain with a neat sketch the governing of impulse turbine.	05	U	2	2
4	Explain the storage river plant, pumped storage plant.	05	U	2	2

8

IV- Semester Diploma Examination
Course Title: **POWER PLANT ENGINEERING**

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. Define a) Peak load b) Base load
2. List the various factors affecting the operation of power plant
3. List the advantages and disadvantages of hydro electric power plants
4. List the advantages of gas turbine power plant with nuclear power plant
5. List the Factors affecting distribution of Wind energy.
6. List the advantages of wind power plant
7. List Social and Economical issues related to power plants
8. List the limitations of nuclear power plant.
9. List the fuels used in thermal power plant.

PART-B   7x10=70 marks

1. Explain Demand factor and Load curve
2. Explain the various considerations while calculating cost of electrical energy.
3. Make use of Sketch explain the layout of hydro power plant
4. Make use of Sketch explain ash handling system
5. Make use of Sketch explain electrostatic precipitation (ESP) system
6. Explain the various methods involved in disposing of nuclear wastes
7. Explain briefly about green house effect.
8. Explain briefly about radiations from nuclear power plant effluents.
9. Explain with a neat sketch unit and central pulverizing systems.
10. Make use of Sketch explain the line diagram nuclear power plant

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Directorate Of Technical Education   Karnataka StateMECH   15ME63B

MODEL QUESTION BANK

Diploma in Mechanical Engineering
IV Semester
Course title: POWER PLANT ENGINEERING

Note: *The paper setter is of liberty to set the questions on his/her desecration based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.*

CO1 Analyze economics of power plants and list factors affecting the power plants and interpret the performance of power plants based on load variations

R-Remember
1. Define power plant
2. List the source of energy
3. List classifications of Power plants
4. List the various factors considered for location of power plants
5. List the various factors affecting the operation of power plant
6. List the principal factors involved in fixing of tariff

U-Understanding
11. Explain with reasons for considering the various factors in identifying the plant locations
12. Explain the importance of load curve in power generation
13. Explain Power plant economics
14. Explain Various factor affecting the operation of power plant
15. Explain Demand factor and Load curve
16. Explain load factor and Demand factor
17. Explain the various types of electrical energy tariffs
18. Explain the choice of power plant
19. Explain load sharing.
20. Explain various considerations while calculating cost of electrical energy.
21. Explain Power plant economics
22. Explain i) Demand factor ii) Load curve
23. Explain i) load factor ii) Demand factor
24. Explain a) Peak load b) Base load

CO2: Identify elements and their functions of, hydro power plants.

REMEMBERING
1. List the essential components of hydro electric power plant.
2. List the different types of hydroelectric power plant
3. List the advantages and disadvantages of hydro electric power plants
4. List the different factors to be considered while selecting the site for hydroelectric power plant.

UNDERSTANDING

1. Explain briefly the necessity of storage and poundage.
2. Explain a typical layout of a hydro electric plant.
3. Explain briefly the essential elements of a hydroelectric power plant.
4. Explain briefly the working the hydroelectric power plant.
5. Explain the base load plant, peak load plant and Run off river plant.
6. Explain the mini and micro hydel plants.
7. Explain with a neat sketch the governing of impulse turbine.
8. Explain with a neat sketch the governing of reaction turbine.
9. Explain briefly the factors involved in selection of turbines

APPLICATION
1. Make use of the Sketch, explain the storage river plant, pumped storage plant
2. Make use of the Sketch, explain the layout of hydrol power plant

CO3: Identify elements and their functions and operations of steam power plants

REMEMBERING
1. List the fuels used in thermal power plant.
2. List the classification of fuel firing.

UNDERSTANDING
3. Explain briefly the working of thermal power plant.
4. Explain the various factors considered for site selection for thermal power plant.
5. Explain different basic materials required for thermal power plants.
6. Explain the different methods of coal handling systems.
7. Explain methods used for coal storage.
8. Explain the principle of overfeed and underfeed stokers.
9. Explain with a neat sketch chain grate stokers.
10. Explain with a neat sketch unit and central pulverizing systems.
11. Explain briefly pulverizing of coal
12. Explain with a neat sketch mechanical feed water treatment.
13. Explain with a neat sketch ball mill.
14. Explain feed water treatment process.

APPLICATION
14. Make use of the Sketch, explain the general layout modern thermal power plant.
15. Make use of the Sketch, explain ash handling system
25. Make use of the Sketch. explain Gravity system
26. Make use of the Sketch ,explain electrostatic precipitation (ESP) system

CO4: Identify elements and their functions and operations of nuclear and gas turbine power plants..

REMEMBERING
1. Define nuclear fusion and nuclear fission
2. Name the different nuclear fuels used for nuclear power plant
3. List the advantages and limitations of nuclear power plant.
4. List the components of gas turbine power plant
5. List the advantages of gas turbine power plant with nuclear power plant
6. List the advantages and limitations of open cycle and closed cycle gas turbine

UNDERSTANDING
1. Compare between nuclear fusion and fission.

11

2. Explain with a neat sketch nuclear power plant.
3. Explain pressurized water reactor (PWR) with a neat sketch.
4. Explain with a neat sketch boiling water reactor (BWR).
5. Explain the effects of nuclear radiation on environment.
6. Explain briefly low, medium and high level waste disposals.
7. Explain with a neat sketch open cycle gas turbine power plant.
8. Explain with a neat sketch closed cycle gas turbine power plant.
9. Explain with a neat sketch the following components of gas turbine
   a) Compressor b) Combustion chamber,
10. Explain with a neat sketch the following components of gas turbine
    a) Gas turbine b) Vortex blading

APPLICATION
1. Choose the various methods involved in disposing of nuclear wastes
2. Make use of the sketch explain closed cycle gas turbine power plant
3. Make use of the sketch explain open cycle gas turbine power plant
4. Make use of the sketch explain the line diagram nuclear power plant

CO5: Identify elements and their functions and operations of solar, wind and diesel power plants

REMEMBERING
1. Define solar period
2. List the Factors affecting distribution of Wind energy.
3. List the advantages of wind power plant
4. List and explain the types of rotors for HAWT.
5. List and explain the types of rotors for VAWT
6. List the Advantages and disadvantages of diesel power plant

UNDERSTANDING

1. Classify the different types of solar cells.
2. Explain briefly about solar cells.
3. Explain maximum power point tracker (MPPT).
4. Explain solar panel.
5. Explain the Variation of wind speed with height and time.
6. Explain with a neat sketch Horizontal axis wind turbine (HAWT).
7. Explain with a neat sketch vertical axis wind turbine(VAWT)
8. Explain with a neat sketch Wind energy conversion system (WECS).

APPLICATION
1. Make use of the Sketch, explain a layout of diesel power plant.
2. Make use of the Sketch, explain the various Components of diesel power plant.
3. Make use of the Sketch, explain working of diesel power plant.

CO6: Know the Social and Economical issues of power plant

REMEMBERING
1. List Social and Economical issues related to power plants.
2. List the reasons for air pollutions due to power plant
3. List the water pollutants arise due to power plant
4. List the methods to control global warming by power plants.
5. List the methods suggested for developing the power plant without pollution

1. Explain about Acid precipitation, Acid rain and acid snow.
2. Explain about Dry deposition and acid fog.
3. Explain briefly about green house effect.
4. Explain the various water and air pollution caused by thermal power plants and its control.
5. Explain about noise pollution caused by power Discuss about Thermal pollution from thermal power plants.
6. Explain briefly about natural and artificial radio activity.
7. Explain briefly about radiations from nuclear power plant effluents.
8. Explain briefly about high level wastes and their disposal.
9. Explain the contribution of power plants for global warming and its effects
10. Explain the purpose of standardization of environmental pollution.
11. Explain the measure to be taken by power plants to avoid air pollution
12. Explain the measure to be taken by power plants to avoid water pollution
13. Explain the measure to be taken by power plants to avoid Noise pollution

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **RENEWABLE ENERGY RESOURCES**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME63C**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Elective**
CEE:25 Marks			SEE:100 Marks

Prerequisites: Knowledge of Applied science, Thermal engineering

Course Objectives:

The energy has become an important and one of the basic infrastructures for the economic development of the country. it is imperative for the sustained growth of the economy. This course envisages the new and renewable source of energy, available in nature and to expose the students on sources of energy crisis and the alternates available, also stress up on the application of non-conventional energy technologies.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand the need of energy conversion and the various methods of energy storage	**R/U/A**	2	**08**
CO2	Explain the field applications of solar energy	**R/U/A**	2,6	**12**
CO3	Identify Winds energy as alternate form of energy and to know how it can be tapped	**R/U/A**	2,6	**11**
CO4	Explain bio gas generation and its impact on environment	**R/U/A**	2,6	**06**
CO5	Understand the Geothermal &Tidal energy, its mechanism of production and its applications	**R/U/A**	2,6	**07**
CO6	Illustrate the concepts of Direct Energy Conversion systems & their applications.	**R/U/A**	2,6	**08**
		Total sessions		**52**

Legend: R: Remember U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
RENEWABLE ENERGY RESOURCES	0	3	0	0	0	2	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	**ENERGY CONSERVATION& STORAGE**	08	5	10	10	25	17.24
2	**SOLAR ENERGY**	10	5	15	10	30	20.68
3	**WIND ENERGY**	08	5	5	10	20	13.80
4	**BIO MASS ENERGY**	08	5	5	10	20	13.80
5	**GEO THERMAL & TIDAL ENERGY**	10	5	15	10	30	20.68
6	**DIRECT ENERGY CONVERSION SYSTEMS**	08	5	5	10	20	13.80
	Total	52	30	55	60	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: ENERGY CONSERVATION & STORAGE   08 Hrs

Energy- Energy Sources & their Availability - Importance of Renewable Energy Resources - Principles of energy conservation- Energy storage- Necessity of energy storage-Energy storage methods- Mechanical Energy storage -Pumped storage-Compressed air storage-Electrical Storage -Lead Acid Battery -Chemical Storage -Energy storage via hydrogen - Electromagnetic energy storage.

UNIT II: SOLAR ENERGY   10 HRS

Solar energy - Introduction-Solar constant- Solar Radiation at the Earth's surface-measurements of solar radiation-pyronometer- pyrheliometer- sunshine recorder –Solar collectors-Classification-liquid flat plate collector-construction-effect of various parameter on its performance-Concentrating collector-Focusing and non-focusing type-Applications of

Solar Energy - solar water heater- Solar Cooker-Box type- Solar dryer-solar greenhouse—Summer and winter greenhouse-solar electric power generation-Solar photovoltaic.

UNIT III: WIND ENERGY   08 HRS

Introduction- Basic Principles of Wind energy conversion-The nature of wind- The power in the wind (No derivations)- Forces on the Blades (No derivations)-Site Selection considerations-Basic components of a wind energy conversion system (WECS)-Advantages & Limitations of WECS-Wind turbines (Wind mill)-Horizontal Axis wind mill-Vertical Axis wind mill-performance of wind mills-Environmental aspects

UNIT IV: BIOMASS ENERGY   08 Hrs

Introduction- Biomass conversion techniques-Biogas Generation-Factors affecting biogas Generation-Types of biogas plants- Advantages and disadvantages of biogas plants-urban waste to energy conversion-MSW incineration plant.

UNIT V: GEO THERMAL & TIDAL ENERGY.   10 HRS

Geothermal Sources-Hydro thermal Sources- a. Vapor dominated systems b. Liquid dominated systems -Prime movers for geothermal energy conversion-Tidal Energy-Basic Principles of Tidal Power-Components of Tidal Power Plants- Schematic Layout of Tidal Power house-Advantages & Limitations of Tidal power.

UNITVI: DIRECT ENERGY CONVERSION SYSTEM   08 Hrs

Thermo - Electric power- Basic Principles-Thermo electric power generator-Thermionic Generation –Introduction-Thermionic emission & work function-Basic Thermionic generator-Chemical Energy Sources-Introduction-Fuel cells – Principles of operation, classification & Types-Applications of fuel cells.

TEXT BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Non-Conventional energy sources.	G.D.Rai	Khanna Publishers
2.	Non-Conventional energy sources-2 E	B.H.Khan	Tata McGraw Hill
3.	Renewable Energy Sources & Emerging Technologies.	D P Kothari, K C Singal&RakeshRanjan	Prentice Hall India
4	Solar energy.	H.P.Garg	McGraw Hill-Education
5.	Energy opportunities and social responsibility.	Satyesh C. Chakraborty	Jaico publications

LIST OF SOFTWARES/ LEARNING WEBSITES:

i. http://nptel.ac.in/courses/112105051/

ii. https://www.youtube.com/watch?v=Ota2_LUuar0

iii. https://www.youtube.com/watch?v=Ota2_LUuar0

iv. https://www.youtube.com/watch?v=3dJAtHaSQ98

v. https://www.youtube.com/watch?v=xokHLFE96h8

vi. http://www.tatapower.com/businesses/renewable-energy.aspx

vii. http://www.cleanlineenergy.com/technology/wind-and-solar

viii. https://www.youtube.com/watch?v=kbuLfXgw4Gs

ix. https://www.youtube.com/watch?v=r9q80sSHxKM

x. https://www.youtube.com/watch?v=GZKKWz_tX1c

xi. download other power plant related videos from youtube.com for study purpose.

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	Energy conservation& storage	lectures and Power point presentations/ Video/ Video movies
2	Solar energy	Lectures/Presentations, Showing charts, Video movies, Industrial visits to solar Installation units
3	Wind energy	Lectures/Presentations, Showing charts, Video movies, Industrial visits to wind mills
4	Bio mass energy	Lectures/Presentations, Showing chart, Industrial visits to nearby Bio mass plant
5	Geo thermal & tidal energy	Lectures/Presentations, Showing chart,
6	Direct energy conversion systems	Lectures/Presentations, Showing chart, Expose to real life industries situation, industrial visits

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Prepare a of monthly energy consumption of your institute and find the ways how it can be conserved
2	Conduct an energy audit of your institute; suggest the ways how the conventional energy resources utilization can be minimized. Suggest the areas ,where the non-conventional energy may be used
3	Identify the solar intensity and wind speed in your institute locality and calculate the intensity of Solar/Wind Power can be generated.
4	Visit to web site of ministry of renewable energy ,Government of India: http://mnre.gov.in/ make a Study on 'Developmental Impact and Sustainable Governance aspects of Renewable Energy Projects'
5	Visit solar power plant /wind power plant available in your locality/ nearer to your institute and understand different elements, working, and note the power generation by these plants

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: The following documents to be verified by CIE verifier at the end of semester
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks and should be assessed on RUBRICS
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

RUBRICS MODEL

Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
**RUBRICS FOR ACTIVITY(5 Marks)**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
**Average / Total marks=(4+5+3+2)/4=14/4=3.5=4**	

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	VI SEM	**RENEWABLE ENERGY RESOURCES**	20
	Year: 2016-17	Course code:15ME63C	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	List out the primary and secondary energy sources OR What are the categories of energy storage system.	5	R	1	2,6
2	Explain lead acid battery, with a neat sketch	5	U	1	2,6
3	Define solar collectors and list the types of collectors	5	R	2	2,6
4	1. Identify the sources of commercial energy. OR 1. Analyse, the sun tracking helps in energy collection by a flat plate solar collector.	5	A	1,2	2,6

Directorate Of Technical Education   Karnataka StateMECH   15ME63C

VI- Semester Diploma Examination

Course Title: **RENEWABLE ENERGY RESOURCES**

Time: **3 Hours**]   [Max Marks**: 100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A   6x5=30 marks

1. What is the necessity of energy conservation and list its various aspects.
2. List the advantages and disadvantages of wind turbines
3. Identify the applications and advantages of flat plate collector.
4. List the usable forms of biomass, their composition and fuel properties
5. Explain the five categories geothermal sources
6. List the advantages and disadvantages of fuel cells
7. Explain solar greenhouse
8. Explain hydro thermal sources
9. Explain briefly about bio diesel plants

PART-B   7x10=70 marks

1. Explain the various aspects of energy conservation.
2. Explain about the solar collectors and its types
3. Explain the forces acting on wind blades.
4. Explain with a neat sketch fixed dome digester
5. Compare the relative performances of a floating drum and fixed dome type biogas plants.
6. Explain with a neat sketch basic thermo ionic generator.
7. Select the considerations for site to install tidal energy .
8. Illustrate the seeded inert gas system with a neat sketch.
9. Making use of a sketch explain the single basic arrangement of tidal power generation.
10. Explain with a neat sketch seeded inert gas system.

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Directorate Of Technical Education   Karnataka StateMECH   15ME63C

Diploma in Mechanical Engineering
IV Semester
Course title: MECHANICS OF MACHINES

CO1: understand the need of energy conversion and the various methods of energy storage

REMEMBERING

1. Define primary and secondary energy sources.
2. Define Renewable and non renewable energy sources.
3. List out primary and secondary energy sources.
4. List the various Renewable and non renewable energy sources.
5. List the advantages and limitations of conventional energy sources.
6. List the advantages and limitations of non conventional energy sources.
7. List the categories of energy storage system.

UNDERSTANDING
1. Explain conventional energy sources.
2. Explain the concept of renewable energy
3. Explain the primary and secondary sources and their availability.
4. Explain the importance of renewable energy sources compared to Non renewable energy sources.
5. Explain the necessity of energy conservation and its various aspects.
6. Explain various principles of energy conservation.
7. Explain energy storage concepts and list the devices available.
8. Explain the necessity of energy storage system
9. Explain pumped hydro-electric energy storage system with a schematic diagram.
10. Explain compressed air storage system with a schematic diagram.
11. Explain lead acid battery, with a neat sketch.
12. Explain chemical energy storage via hydrogen.

APPLICATION
2. Develop the per-capita energy consumption related with standard of living.
3. Identify the sources of commercial energy.
4. Identify the necessity of energy conservation and Explain its various aspects

CO2 : Explain the field applications of solar energy

REMEMBERING

1. Define solar constant.
2. Define beam, diffused and global radiation
3. Define solar irradiance, solar constant, extra terrestrial and terrestrial radiations

4. Define solar collectors and list the types of collectors.
5. List the applications of flat plate collector.
6. Label the different parts of a parabolic collector with a neat sketch.
7. List the advantages and disadvantages of concentrating collector over flat plate collector.
8. List the advantages and disadvantages of flat plate collector

UNDERSTANDING

1. Explain solar energy engineering.
2. Explain the amount of solar energy available at the earth's surface with suitable equation.
3. Infer the average amount of solar energy available at the day time.
4. Explain about solar radiation measurements.
5. Explain beam radiation, diffused radiation and global radiation.
6. Summarise the reasons for variation in solar radiation reaching the earth than received at outside of the atmosphere
7. Explain pyrheliometer and pyronometer.
8. Explain in brief about sunshine recorder.
9. Explain the construction and principle of operation of a sunshine recorder.
10. Explain basic features required in an ideal pyronometer.
11. Explain with a neat sketch typical flat plate liquid collector.
12. Explain with a neat sketch solar air heater and air collector.
13. Explain parabolic focussing collector.
14. Explain non focussing collector (Flat plate collector augmented with mirrors).
15. Explain the effect of various parameters on the performance of flat plate collector.
16. Explain the effect of various parameters on the performance of concentrating collector.
17. Explain with a neat sketch solar water heater.
18. Explain with a neat sketch box type solar cooker.
19. Explain with a neat sketch working of solar dryer.
20. Explain solar greenhouse.
21. Explain briefly about the supply of adequate amount of CO_2 maintained in greenhouse.
22. Explain with a neat sketch winter green house.
23. Explain with a neat sketch summer green house.
24. Explain the principle of solar electric power generation (solar photovoltaic).
25. Explain selective coatings used in solar collectors.

APPLICATION

2. Identify the reasons for solar energy collection getting affected by tilting a flat plate collector with respect to the ground.
3. Analyse, the sun tracking helps in energy collection by a flat plate solar collector.
4. Choose the best coatings used in solar collectors for higher efficiency.
5. Select the best two applications of solar energy and explain in brief.

CO3: Identify wind energy as alternate form of energy and to know how it can be tapped

REMEMBERING
1. List the forces responsible for determining the speed and direction of global winds.
2. List the factors led to accelerated development of wind power?
3. List the factors affecting the distribution of wind energy system on the surface of the earth.

4. List the advantages and disadvantages of wind turbines.
5. List the advantages and limitations of horizontal wind turbine.
6. List the advantages and limitations of vertical wind turbine.
7. How wind energy impacts on Environment.

UNDERSTANDING

1. Outline the circulation of global winds with a help of schematic diagram.
2. Explain the mechanism for production of local winds.
3. Infer the range of wind speed is considered favourable for wind power generation.
4. Explain the basic principle of wind energy conversion.
5. Explain the forces acting on wind blades.
6. Explain the concept of lift and drag.
7. Explain the relative features of lift and drag type machines.
8. Summarise the main considerations in selecting a site for wind generators.
9. Explain with a neat sketch working of a wind energy conversion system(WECS) with main components.
10. Explain the components of wind energy conversion systems.
11. Explain with neat sketch horizontal and vertical axis wind system.
12. Explain the present prospectus of wind energy in India.

APPLICATION
1. Choose the favourable factors required in site for installing the wind turbines.
2. Choose the favourable factors for selecting a site for installing wind generators.

CO4: Explain bio gas generation and its impact on environment

REMEMBERING
1. List the usable forms of biomass, their compositions.
2. List the fuel properties.
3. List the advantages and disadvantages of biomass energy
4. List the main advantages of anaerobic digestion of biomass
5. List the factors affecting biogas generation.
6. What are the advantages and disadvantages of biogas plants.
7. List the main plants proposed for energy plantation.

UNDERSTANDING
1. Summarise in brief about the introduction of bio energy engineering.
2. Explain the process of formation of bio-mass energy.
3. Explain clearly the term biomass and biogas.
4. Explain different types of bio fuels.
5. Explain thermo chemical conversions, fermentation and anaerobic digestion.
6. Explain the composition of biogas.
7. Illustrate the various biomass conversion processes.
8. Illustrate biogas processes such digestion.
9. Explain the types of biogas plant.
10. Explain with a neat sketch floating drum type biogas plant.
11. Explain with a neat sketch fixed dome digester.
12. Compare the relative performances of a floating drum and fixed dome type biogas plants.
13. Explain with the help of block diagram ,the working of MSW incineration plant.

14. Illustrate about urban waste to energy conversion via MSW incineration method
15. Explain energy plantation, list the advantages and disadvantages
16. Explain briefly about bio diesel plants

APPLICATION
1. Identify the various biomass conversion processes.
2. Making use of a sketch explain the types of biogas plants
3. Develop the general approximate composition of MSW, discuss its heating value and discuss the problems in its development
4. Making use of MSW incineration method, how to convert urban waste in to energy.

CO5: Understand the geothermal &tidal energy, its mechanism of production & its applications

REMEMBERING
1. Define geothermal sources.
2. What is geothermal energy.
3. List the advantages and disadvantages of geothermal energy forms.
4. List the main applications of geothermal energy.
5. Choose the places of geothermal occurrence in India.
6. List the advantages and disadvantages of tidal power.
7. List the main hurdles in development of tidal energy.
8. Choose the potential sites for tidal energy in India .

UNDERSTANDING
1. Infer the origin and distribution of geothermal energy
2. Infer the nature of geothermal fields.
3. Explain the five categories geothermal sources.
4. Explain hydro thermal sources.
5. Explain with a neat sketch vapour dominated systems.
6. Explain with a neat sketch liquid dominated systems.
7. List the various applications of direct heating and Electric generation .
8. Illustrate the environmental impacts of geothermal energy .
9. Infer the present prospectus of geothermal energy in context to India.
10. Explain the sources of tidal energy, Discuss the minimum tidal range required for practical tidal plant.
11. Explain the basic principles of tidal power.
12. List the components of tidal power plants.
13. Explain with a neat sketch tidal power plant
14. Explain with a neat sketch the single basic principle of tidal power generation.
15. Explain the considerations for site selection of tidal energy.
16. Infer the prospectus of tidal power in India.

APPLICATION

1. Identify various the categories of geo-thermal fields.
2. Making use of diagram explain the Vapour dominated and Liquid dominated systems..

3. Identify the various applications of direct heating and Electric generation .
4. Identify the environmental impacts of geothermal energy.
5. Select the considerations for site to install tidal energy.

CO6: Illustrate the concepts of direct energy conversion systems & their applications.

REMEMBERING

1. List the MHD systems and classifications of MHD systems.
2. List the advantages of MHD systems.
3. What are the sources of chemical energy.
4. List the advantages and disadvantages of fuel cells.
5. What are the applications of fuel cells.

UNDERSTANDING

1. Explain the meaning of direct energy conversion systems.
2. Illustrate the principle of MHD generation.
3. Compare Open and closed cycle MHD system.
4. Explain with a neat sketch seeded inert gas system.
5. Explain the see beck effect and principle of thermo couple.
6. Explain joule effect, peltier effect and Thomson effect.
7. Explain thermo electric power generators.
8. Explain thermionic emission and work function.
9. Explain with a neat sketch basic thermo ionic generator
10. Illustrate the principle of operation of fuel cell.
11. Explain the types of fuel cell
12. Classify the fuel cells

APPLICATION

1. Identify the sources of chemical energy .
2. Making use of a Sketch, explain the seeded inert gas system

	Course Title: **REFRIGERATION AND AIR CONDITIONING**		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15ME63F**
	Type of Course: **Lectures, Self Study & Quiz**	Credit :**04**	Core/ Elective: **Elective**
CIE: 25 Marks			SEE:100 Marks

Prerequisites: Knowledge of Applied science, Engineering Mathematics, Thermal engineering

Course Objectives:

Apply knowledge of mechanical engineering related to Refrigeration and Air conditioning equipments and expose the importance of refrigeration equipments, their control and repair and overhauling of these systems.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

	Course Outcome	**CL**	**Linked PO**	**Teaching Hrs**
CO1	Understand the principle of refrigeration and Know the types of refrigeration	*R/U/A*	1,2	**07**
CO2	Explain the concept of various refrigeration systems and familiar with their advantages and disadvantages	*R/U/A*	1,2	**10**
CO3	Know the constructional and working of refrigeration equipments such as Compressor, condensers and Evaporators and the refrigerant flow controls	*R/U*	2	**12**
CO4	Know the different types of refrigerants and Application of refrigeration to various areas	*R/U/A*	2	**07**
CO5	Appreciate the concept of Air Conditioning and know their types	*R/U/A*	2	**08**
CO6	Familiarize the different tools used to install refrigeration system and Air Conditioner	*U*	2	**08**
		Total sessions		**52**

Legend: R: Remember U: understand A: Application An: Analysis

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
REFRIGERATION & AIR CONDITIONING	1	3	0	0	0	0	0	0	0	0

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.
Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	**INTRODUCTION TO REFRIGERATION**	07	5	5	5	15	10.34
2	**REFRIGERATION CYCLES**	10	5	5	20	30	20.68
3	**REFRIGERANTS, SYSTEM COMPONENTS**	12	5	10	20	35	24.13
4	**APPLICATION OF REFRIGERATION**	07	-	5	10	15	10.34
5	**AIR CONDITIONING**	08	5	5	10	20	17.24
6	**REFRIGERATION AND AIR-CONDITIONING TOOLS**	08	5	10	5	20	17.24
	Total	52	15	40	80	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: INTRODUCTION TO REFRIGERATION   07Hrs

Refrigeration-Definition-Refrigerating effect-unit of refrigeration- Coefficient of performance-Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration-Carnot refrigeration Cycle-Air refrigeration/Bell Coleman cycle, PV& TS diagram,(without derivation)-Advantage and disadvantages in air refrigeration-Simple problems.

UNIT II: REFRIGERATION CYCLES   10Hrs

Vapour compression refrigeration cycle - Basic Components,-Flow diagram of working of Vapour compression cycle - Representation of the vapour compression cycle on P-H, T-S & P-V Diagram - Expression for Refrigerating effect, work done and power required - Types of Vapour Compression cycle - Effects of super heating and under cooling, its advantages and disadvantages - Vapour Absorption refrigeration cycle- Flow diagram of working of Vapour Absorption cycle- Comparison of Vapour absorption and vapour compression system- Simple Electrolux system for domestic units-Simple problems on simple vapour compression cycle only

UNIT III: REFRIGERATION COMPONENTS &FLOWCONTROLS   12Hrs

Compressors - types of compressors, -Reciprocating compressor-Centrifugal compressor-Hermetically sealed compressor-- condensers - Air Cooled, water cooled -evaporators – natural convection, forced convection types –Flow controls- Capillary tube- Automatic Expansion valve-Solenoid valve.

UNIT IV: REFRIGERENTS &APPLICATION OF REFRIGERATION   07Hrs

Refrigerants - properties - selection of refrigerants- Detection of refrigerants leakage- Alternate Refrigerants- testing and charging of refrigeration units –Applications of refrigeration- Cold storage -Dairy refrigeration-Icemaking industry-Transport refrigeration. Introduction to cryogenic engineering-concept.

UNIT V: AIR CONDITIONING   08 Hrs

Air conditioning –Definition- Factors affecting Air conditioning-Psychrometric processes- sensible heating and cooling-Humidifying and dehumidifying-Air conditioning types-List-Summer-Winter-use of psychometric charts- Equipments used in air conditioning cycle-air filter-dry air filter-humidifier-Types-Steam injection type humidifier-Dehumidifier-Spray type dehumidifier-Fans and blowers-Axial flow and centrifugal flow.

UNIT VI: REFRIGERATION & AIRCONDITIONING TOOLS   08Hrs

Tools used in refrigeration system- Tools used in Air conditioner installation- Installation procedure of refrigeration systems, charging ,testing, adding the oil to compressor , - Faults in refrigeration and air conditioning system- Servicing procedure of Refrigeration system

TEXT BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Refrigeration and Air Conditioning	Domkundwar- Arora C P	Dhanpat rai and co.
2.	Refrigeration and Air Conditioning	Arora C P	Tata McGraw-Hill New Delhi, 3rd Edition, 2010
3	Basic Refrigetaion And air – conditioning	P N Anathanarayan	-
4.	Principles of Refrigeration	Roy.J Dossat,	Pearson Education, 4th Edition , 2006
5	Refrigeration and Air Conditioning	Jordon and Prister,	Prentice Hall of India PVT Ltd., New Delhi, 1985.
6	Refrigeration and Air Conditioning	Stoecker N.F and Jones,	TMH NewDelhi,2nd Edition 1982.

i. http://nptel.ac.in/courses/112105051/

ii download other power plant related videos from youtube.com for study purpose.

SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	**Introduction to refrigeration**	lectures and Power point presentations/ Video/ Video movies
2	**Refrigeration cycles**	Lectures/Presentations, Showing charts,
3	**Refrigerants, system components**	Lectures/Presentations, Showing charts, Industrial visits to refrigerator repair shops
4	**Application of refrigeration**	Lectures/Presentations, Showing charts, Industrial visits to Cold storage
5	**Air conditioning**	Lectures/Presentations, Showing chart, Video/ Video movies
6	**Refrigeration and air-conditioning tools**	Lectures/Presentations, Showing charts, Industrial visits to Refrigerator/Air conditioner repair work shops

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Prepare list of various major power plants installed in Karnataka along with their total capacity.
2	Prepare charts of different high pressure boilers, gas turbine cycles, steam turbine power plant, wind turbine power plant, solar power plant, etc. on half imperial drawing sheet. Attach the same with term work.
3	Visit websites of NTPC, BHEL,, NHPC, NPCIL, GEDA, SUZLON, GE, SIEMENS, ENERCON and KPC etc and find out the technical information about their machineries or Plants.
4	Download technical specifications/ catalogues, videos or any other suitable presentations on gas turbine power plant
5	Download technical specifications/ catalogues, videos or any other suitable presentations on gas turbine power plant.
6	Visit diesel power plant available in your institute/ nearer to your institute and understand different elements, working, circuits, and specifications.

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation   SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods

- **MODEL OF RUBRICS /CRITERIA FOR ASSESSING STUDENT ACTIVITY**

RUBRICS FOR ACTIVITY(5 Marks)					
Dimension	**Unsatisfactory**	**Developing**	**Satisfactory**	**Good**	**Exemplary**	**Student Score**
	1	**2**	**3**	**4**	**5**	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5

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		Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
				Average / Total marks=(4+5+3+2)/4=14/4=3.5=4		

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	IVSEM	**REFRIGERATION AND AIR CONDITIONING**	20
	Year: 2016-17	Course code:15ME63F	

Name of Course coordinator :   Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	MARKS	CL	CO	PO
1	Define 1 ton of refrigeration. Show how one ton refrigeration is expressed in kW. OR Or Explain refrigeration by throttling process with temperature -pressure diagram	05	U	1	2
2	List the advantages and disadvantages of vapour refrigeration over air refrigeration system.	05	R	2	2
3	An ammonia refrigerator produces 20 tones of ice at 0^0C in 24 hours. The temperature range of the system is -15^0C. The vapour leaving the compressor's dry-saturated. Assuming actual COP is 75% of theoretical, calculate the power required to run the compressor. Take latent heat of ice as 335 kJ/kg. Use the following properties of ammonia.	10	A	2	1,2

Saturation temp in ^{0}C	Enthalpy(kJ/kg)		Entropy(kJ/kg-K)	
	h_f	h_g	s_f	s_g
25	99.94	1317.95	0.3469	4.4816
-15	-54.50	1303.74	-0.2132	5.0536

VI- Semester Diploma Examination

Course Title: **REFRIGERATION AND AIR CONDITIONING**

Time: **3 Hours**]   [Max   Marks**:   100**

Note: Answer any **SIX** from Part A and any **SEVEN** from Part B

PART-A   6x5=30 marks

1. Define the following terms:
   - i. Refrigeration
   - ii. Refrigerating effect
2. List the advantages and disadvantages of under cooling in the VCR system.
3. Define compressor, condenser.
4. Define refrigerant. List the types of refrigerant leak detector
5. Define following psychrometric properties
   a. WBT
   b. DBT
   c. Humidity
   d. Relative humidity
   e. Dew point temp.
6. Explain the procedure of adding the oil to compressor
7. Explain hermetically sealed compressors.
8. Explain the effect of under cooling on the COP of a vapour compression refrigeration cycle with T-S diagram
9. Build the expression for volumetric efficiency of reciprocating compressor with P-V diagram.

PART-B   7x10=70 marks

1) a. Explain refrigeration by throttling process with temperature -pressure
      diagram.   05
   b. Ice is formed at 0^0C from water at 20^0C. The temperature of brine
      solution is-10^0C reversible carnot cycle. Latent heat of ice is = 336kj/kg.
      find the Kg of ice formed per 1kWhr.Assume the refrigeration cycle is
      perfect.   05

2) Develop an expression for work done and COP of a vapour compression   refrigeration cycle(dry saturated) with T-S diagram.

3) 1An ammonia refrigerator produces 20 tones of ice at 0^0C in 24 hours. The   temperature range of the system is -15^0C. The vapour leaving the compressor's dry-saturated. Assuming actual COP is 75% of theoretical, calculate the power required to run the compressor. Take latent heat of ice as 335 kJ/kg. Use the following properties of ammonia.

Saturation temp	Enthalpy(kJ/kg)	Entropy(kJ/kg-K)

in ^{0}C	h_f	h_g	s_f	s_g
25	99.94	1317.95	0.3469	4.4816
-15	-54.50	1303.74	-0.2132	5.0536

10

4) Explain with sketch the natural convection evaporator(with and without   baffle).

5) A. Write a note on automatic expansion valve with neat sketch.   05

   B. Explain with sketch the operation of solenoid valve for variable refrigerant flow control.
05

6) a. Explain on transport refrigeration.   05

   b. List any five essential properties of good refrigerants.   05

7) a. List any four different types of air filters used in air conditioning   04

   b. Explain bag type dry air filter with sketch.   06

8) Explain the causes for faults in refrigeration system   10

9) Select the procedure should be adopted for replacing the evaporator(with
   and without valves) from the system   10

10) a. Explain with sketch the winter air conditioning system for mild and cold
   weather.   07

   b. Classify refrigerants.   03

****

Diploma in Mechanical Engineering
VI Semester

CO1: Understand the principle of refrigeration and know the types of refrigeration

REMEMBERING

1) Define the following terms:
   - i. Refrigeration
   - ii. Refrigerating effect
   - iii. Ton of refrigerator
   - iv. Heat pump
   - v. Refrigerator
   - vi. COP
2) Define 1 ton of refrigeration. Show how one ton refrigeration is expressed in kW.
3) Name five means of producing refrigeration.
4) List the advantages and disadvantages liquid nitrogen refrigeration with Specific field of application.
5) List the advantages and disadvantages Air refrigeration with specific field of application.

UNDERSTANDING

1) Explain how a refrigerant produces cooling effect?
2) Explain how the ice can be used for refrigeration? Is it possible to produce the temperature below zero degree with the help of ice?
3) Compare the direct and indirect refrigeration system with advantages and disadvantages.
4) Explain refrigeration by throttling process with temperature -pressure diagram.

APPLICATION

5) Make use of sketch explain dry ice refrigeration
6) Make use of sketch explain Steam jet refrigeration
7) Make use of sketch Explain liquid nitrogen refrigeration

8) Make use of sketch Explain Carnot refrigeration Cycle with with PV and TS diagram.

9) Make use of sketch Explain Air refrigeration/ Bell-Coleman refrigeration Cycle with with PV and TS diagram.

10) Ice is formed at 0^0C from water at 20^0C. The temperature of brine solution is -10^0C reversible carnot cycle. Latent heat of ice is $= 336kj/kg$. find the Kg of ice formed per 1kWhr.Assume the refrigeration cycle is perfect

11) A Carnot refrigerator extracts 400 kJ of heat per minute from a cold room which is maintained at -15^0 C and it is discharged to atmosphere which is at 30^0 C. Find an ideal kW-capacity of motor required to run the unit.

12) A reversed Carnot cycle is used to deliver 1680kJ/sec to heat the conditional space. The heat is taken from atmosphere at 100C and supplied to the conditional space at 25^0C. Find the followings: If the same quantity of heat is supplied by electric heaters, find the
   a. kW required to run the system
   b. consumption of electric energy in kW.

CO2: **Explain the concept of various refrigeration systems and familiar with their advantages and disadvantages**

REMEMBERING

1) List the advantages and disadvantages of vapour refrigeration over air refrigeration system.
2) List the advantages and disadvantages of superheating in the VCR system.
3) List the advantages and disadvantages of under cooling in the VCR system.

   UNDERSTANDING

1) Compare vapour compression refrigeration system over vapour absorption refrigeration system.

APPLICATION

2) Make use of a flow diagram Explain the working principle of vapour compression refrigeration cycle.
3) Make use of P-v and T-S diagram explain the working of vapour compression refrigeration cycle.

4) Develop an expression for work done and COP of a vapour compression refrigeration cycle (dry saturated) with T-S diagram.
5) Develop an expression for work done and COP of a vapour compression refrigeration cycle (superheated) with T-S diagram.
6) Make use of T-S diagram explain the effect of under cooling on the COP of a vapour compression refrigeration cycle
7) Make use of T-S diagram Explain the effect of superheating on the COP of a vapour compression refrigeration cycle .

8) Make use of a flow diagram Explain the working principle of simple vapour absorption refrigeration cycle.
9) Make use of a flow diagram Explain the working principle of ammonia absorption refrigeration cycle.
10) Make use of a flow diagram Explain the working principle of Domestic Electrolux refrigeration cycle.
11) An ammonia refrigerator produces 20 tones of ice at 0^0C in 24 hours. The temperature range of the system is -15^0C. The vapour leaving the compressor's dry-saturated. Assuming actual COP is 75% of theoretical, calculate the power required to run the compressor. Take latent heat of ice as 335 kJ/kg. Use the following properties of ammonia.

Saturation temp in ^0C	Enthalpy(kJ/kg)		Entropy(kJ/kg-K)	
	h_f	h_g	s_f	s_g
25	99.94	1317.95	0.3469	4.4816
-15	-54.50	1303.74	-0.2132	5.0536

12) An ammonia refrigerator works between -6.7^0C and 26^0C. The vapour is dry saturated at the end of compression. Calculate
   a. Theoretical COP
   b. Power required to drive the compressor.
      If the cooling capacity of the refrigerant is 5 tons. Use the following properties of ammonia(NH_3)

Saturation temp in ^0C	Specific Enthalpy(kJ/kg)		Specific Entropy(kJ/kg-K)	
	Liquid h_f	Saturated vapour h_g	Liquid s_f	Saturated vapour s_g
-6.7	-29.26	1262.36	0.1087	4.7401
26.7	124.56	1291.62	0.4264	4.3263

REMEMBER

1) Define compressor.
2) List the different types of compressors.
3) Define volumetric efficiency of a compressor.
4) Define condenser.
5) List the different types of condensers.
6) Define evaporator.
7) List the different types of evaporators.
8) List the different types of expansion devices.
9) List the advantages and disadvantages of capillary tube.

UNDERSTANDING

1) Explain hermetically sealed compressors.
2) Explain with reasons the fields of applications of each type of compressor in refrigeration system.
3) Outline the advantages and disadvantages of centrifugal compressor over reciprocating compressor.
4) Compare air cooled and water cooled condensers.
5) Explain the functions of expansion devices.

APPLICATION

1) Make use of P-V diagram Explain the cycle of working of reciprocating compressor
2) Make use of flow and P-H diagram Explain the working of centrifugal compressor
3) Make use of sketch Explain the working of air cooled condenser
4) Make use of sketch Explain the working of water cooled condenser
5) Make use of sketch Explain the natural convection evaporator(with and without baffle).
6) Make use of sketch Explain the forced convection evaporator.
7) Make use of sketch explain automatic expansion valve with neat sketch.
8) Make use of sketch Explain the operation of solenoid valve for high temperature in evaporators.

9)   Make use of sketch Explain the operation of solenoid valve for low temperature in evaporators.

10)   Make use of sketch Explain the operation of solenoid valve for variable refrigerant flow control.

REMEMBER

1) Define refrigerant.
2) List the types of leak detector.

UNDERSTANDING

1) Classify refrigerants.
2) Explain the factors affecting the choice of refrigerants commonly used in refrigerating plants.
3) Outline the essential properties of good refrigerants.
4) Outline the factors are considered in selecting refrigerants in the following system and name the refrigerant in each system
    a. House hold refrigerator.
    b. Ice producing plant.
    c. Air conditioning plant.
5) Explain electronic leak detector.

APPLICATION

1) Choose the various factors to be considered to design cold storage
2) Choose the various factors to be considered to design quick freezing.

REMEMBERING
1. Define Air conditioning.
2. List different factors affecting air conditioning.
3. Define psychrometry.
4. List and define psychrometric properties.
5. List different air conditioning equipments.
6. List different types of air filters used in air conditioning.
7. List different types of humidifiers used in air conditioning.

8. List different types of dehumidifiers used in air conditioning.
9. List different types of blowers used in air conditioning.
10. List the major difference between fans and blowers.

UNDERSTANDING

1. Explain briefly different factors affecting air conditioning.

APPLICATION

1. Make use of sketch Explain psychrometric chart
2. Make use of sketch Explain sensible heating
3. Make use of sketch Explain sensible Cooling
4. Make use of sketch Explain the summer air conditioning system for hot and dry outdoor conditions.
5. Make use of sketch Explain the summer air conditioning system for hot and humid outdoor conditions.
6. Make use of sketch Explain the winter air conditioning system for mild and cold weather.
7. Make use of sketch explain the following
    a. Cooling with dehumidification
    b. Cooling with adiabatic humidification of air
    c. Cooling with dehumidification.
8. Make use of sketch Explain Steam injection type humidifier.
9. Make use of sketch Explain Spray type dehumidifier.
10. Make use of sketch Explain Axial flow fans.
11. Make use of sketch Explain centrifugal flow fans.

CO6: Familiarize the different tools used to install refrigeration system and Air Conditioner

UNDERSTANDING

1) Explain the different instruments used for the measurement of temperature, pressure, electricity, velocity of air and flow of air(Ref. Basic Refrigeration and Air Conditioning-P N Ananthanarayanan)
2) Explain the installation procedure for refrigerating units.
3) Explain the charging of refrigerating unit with neat sketch.
4) Explain the procedure of adding the oil to compressor.
5) Explain the different tests for refrigerants leakage.

6) Explain the procedure of removing the compressor from refrigeration non sealed unit.
7) Explain the procedure of removing the compressor from refrigeration sealed unit.
8) Explain the steps to be followed before disconnecting the condenser from the refrigeration system.
9) Explain the procedure should be adopted for replacing the evaporator(with and without valves) from the system.
10) Outline the points should be remembered for the maintenance of household refrigerator
11) Explain the causes for faults in refrigeration system.